# THE DEARMAN SYSTEM MATHEY TIÉARMAN Smarter, Tougher, Mathev.

# THE PROVEN CONCEPT OF PIPEFITTING FOR WELDING

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THIS BOOK IS AN INTRODUCTION TO

# DEARMAN SYSTEM

# PIPE FIT-UP TOOLS FOR WELDING

Published in honor of Tim Dearman

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**M** athey Dearman, Inc., as a manufacturer, goes "One Step Beyond" to meet welding and pipeline needs. It markets patented Cutting and Beveling Machines for all types of pipe and pipe diameters; Pipe Alignment and Reforming Clamps for welders and pipe fitters requiring fast, accurate fit-up; and Smaller Pipe Tools. Quality controlled, service minded—Mathey Dearman Products are the best in the marketplace, maintaining competitive pricing both locally and internationally.

Please visit www.mathey.com for MORE— New and Innovative Mathey Dearman Products!

# DEARMAN SYSTEM PIPE FIT-UP TOOLS FOR WELDING

# BETTER QUALITY FIT-UPS FASTER AND EASIER GREATER SAFETY AND PRODUCTIVITY

# HISTORY

A aving accumulated twenty-five years of welding experience, including supervision of pipeline construction, Tim Dearman had ample exposure to the primitive methods used to fit up pipe and pipe fittings. Convinced there was a better, faster, cheaper way to align pipe and fittings, Tim Dearman worked nights and on weekends to build prototypes of Pipe Fitter's Tools and put them out for field-testing. The reception of these tools exceeded his fondest expectations. Encouraged by the reports from professional pipe fitters and welders, who were using the tools in the field, Tim Dearman withdrew \$2,200.00 from his savings in 1970 to secure patents and to manufacture the Proven Dearman Products. Today the tools that Tim Dearman produced are known throughout the world for durability and quality of workmanship. The product line was added to the Mathey Dearman Pipe Cutting and Beveling Machine Products in 1996.

**S** ince the integration of the two companies, we have diligently continued to follow the philosophy of Tim Dearman, always looking for opportunities to improve the durability and accuracy of our products in all types of environments by testing, redesigning, researching and continued development. Mathey Dearman, Inc. works continuously to find the best ways to help pipe fitters by offering tools and equipment that allow you to work with more accuracy, speed, and safety.

# The World's Largest Selection of Hand Tools Designed Specifically for the Pipe Fitter and Welder.



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DEARMAN CLAMPS are adjustable for over 100 fit-ups on a variety of pipe-sizes. These are just a few for the 4"-16" Clamp.

Just to show you what a large measure you get with DEARMAN TOOLS: per dollars spent—DEARMAN CLAMP OF 30lbs. does more than the conventional clamp that weighs 367 lbs. and will out perform 100-1, for LESS MONEY.



# SOMETHING SPECIAL FOR THE PIPE FITTER

#### GENTLEMEN:

Pipe fitting and welding are extremely important to many businesses in today's fast-paced, energy conscious world. Energy producers use miles of pipe. Good pipe fitters and welders are in high demand. When you think of all the piping used today and what's going to be needed for tomorrow, think of all the bad fit-ups that could be made and the faulty welds that could result. You know the quality of any job depends on the right tools to get the job done, and above all, a good person that knows how to use them. That's why the **DEARMAN Systems** for pipe fitting are something special – "**designed to help you be more of a professional at your job**".

For over 25 years, I have been associated with pipe fitting. During those years, I have seen some very crude and unprofessional methods because there wasn't any better way. I decided there had to be a better way so I started working to find a system that would help the fitter and welder. Through trial and error, many long hours, and plain hard work, I have developed methods of pipe fitting for welding, using specially designed equipment, that are easy to apply and totally safe for the fitter and welder. This system, the **DEARMAN System**, has become a standard with our trade.

A pipe fitter, using the **DEARMAN System** and equipment I have designed, built and tested, no longer has to hold the fitting during welding. After a fit-up the fitter can safely turn his back while the welder tacks or welds. This eliminates the daily hazard of arc spatter and eye burns we all know so well. **DEARMAN** tools provide the means of making precise fitups, which the welder needs, to do a professional job and meet today's rigid specifications.

Still the **DEARMAN System** doesn't work alone, it takes a good team to make it work; men who are interested in doing an easier and more professional job and whom aren't satisfied with second best, **but want the very BEST.** 

The DEARMAN System is nothing more than common sense usage of specially designed equipment – that results in a professional and safe job unequalled by any other system. My system will show the fitter a better way to fit-up pipe, plus give the welder a professional fit-up, remove hazards to the worker and give quality control people top rated results. We no longer have to put up with substitute methods for fit-ups, faulty welds due to bad pipe alignment, needless accidents or unhappy quality control inspectors.

Once you try the **DEARMAN System** and Tools, you will see their value for yourself and request them on your jobs.

Let's read through this handbook and get acquainted with the **NEW**, **PROVEN CONCEPT** of pipe fitting for welding.

I dedicate this book to all of you in our trade.

Sincerely, Tim Dearman

# SOMETHING ESPECIALLY DEVELOPED FOR FITTERS

**PIPE**—to a lot of people the word goes with tobacco. To the Pipefitters and Welders who have laid thousands of miles of metal thoroughfare, the word PIPE means accurate fit-ups and precision welds. It means the back-breaking work of aligning two pieces of pipe correctly. The accurate fit-up shows professionalism and skill; the bad fit-up effects the well-being and safety of a lot of people who depend of the Pipe Fitter and Welders and how well they apply the trade. The pocketbook has a way of showing a <u>bad</u> <u>fit-up</u>... that can cost money and result in costly delays and loss of the job.



You will understand what we're saying if you have been fitting pipe for a while. Let us acquaint you with the following problems if you are new to the trade.

A pipe fitter going to the shop, fingers crossed, hoping he has the right clamp for the job. What does he need? A channel clamp for a flange, a channel type for pipe to pipe, a knuckle buster for pipe to pipe, or maybe the old chill or back-up rings where the smaller I.D. of the fitting doesn't level out with the pipe. He rummages through his large assortment of clamps in the shop and finally, after falling behind in his schedule, comes up with a clamp that will have to do, or maybe he just decides to use lugs and wedges.

(CONTINUED.) DEVELOPED FOR FITTERS



He finally clamps his pipe, or welds his lugs on the pipe for alignment; attempts to align – whoa! No good! Tear the lugs off, clean up the spot, patching needed here, more time used up! Burned hand, arc flash in the eye! Leg's try it again! Clamp let us down that time! Slipped the fitting! Oh well, after lunch we'll really have to hustle! Now he sits on his hard-hat and thinks **"Somehow there has to be a better method than this one!"** Sounds familiar doesn't it?



Welding Clamps have been manufactured and sold for years. Generally, these clamps were the best method at the time, but using them was like digging a ditch with pick and shovel. The clamps just would not do the job adequately enough to meet today's inspection standards.

Such a wide variety of clamps had to be used that the fitter and welder were guessing what to use or what would be best. There wasn't a clamp made to do all that had to be done.



# (CONTINUED.) DEVELOPED FOR FITTERS

Think of all the ways that were improvised by every mechanic on the job. Ears, lugs, lumber, brackets, etc. are still being used by the Pipefitter. Looking at the choice of clamps that were on the market, it is no wonder these men preferred make-shift methods.

Then came the **DEARMAN System**. The **DEARMAN System** is a method that allows you to align the first time. It reduces the possibility of the high-low joint with the use of the **unique "Jackscrew" System**. From experience Mr. Dearman knows that his system makes the job safer for the fitter. The fitter avoids arc spatter and possibility of getting his eyes burned. There's no hammering of wedges, no fear of flying steel to the eyes, no shattered wedges or glancing hammers. Using the **DEARMAN System** he does not have to hold the fitting while it is being welded. Yet the fitter can still make precise fit-ups with ease. No pain, no guess work.



The **DEARMAN System** is based on a *new-proven concept*, developed by a man who has been there, a man with over twenty-five years experience in the field. One day, a few years ago, Tim Dearman really got aggravated. He was tired of using old, crude ways such as welding lugs on pipe for alignment, tearing it off again, cleaning up the spot and probably patching the pipe – in some cases having to acid test the spot on the pipe. Then, after all that time and trouble, an inspector would tell him it wasn't a proper fit-up – cut it out – do it over. We all know how frustrating that can be.



# (CONTINUED.) DEVELOPED FOR FITTERS

Tim Dearman spent weekends, nights and rainy days studying and perfecting his System. He field tested his System time and time again. After a long time and a lot of hard work he invented an efficient, safe, accurate way to do the job and do it right.



Finally, he had it right! The **DEARMAN System** was a reality. To support his method, Tim Dearman revolutionized the industry with the *Dearman Pipe Alignment System*. He designed the *versatile Dearman Clamp and Accessory Tools*, opening a new world to the Pipe Fitter and Welder.

# TERMINOLOGY

# **HIGH-LOW MISMATCH**

Mismatch of two materials that are to be welded together. Outside or inside mismatch can be caused by two different sizes of pipe or pipe that is not rounded or lined up evenly.

#### LANDING ON THE END OF PIPE

Landing on the end of pipe is a small flat edge at the end of the bevel on the longest part of the pipe.

#### **FIRST PASS**

Stringer Bead or Root Pass.

#### SECOND PASS

The second pass of welding is usually called a "hot pass."

#### **FILLER WELD**

The Filler Weld comes before the Cap.

#### CAP WELD

The Cap Weld is the last pass made on the weld.

#### **IN-DOE PIPE**

The phrase to "in-doe" pipe means to move one pipe inwards.

#### SKID

The word "*skids*" usually means a  $4 \times 6$  or  $6 \times 6$  timber used to hold pipe up off the ground on the outside work. In the shop, they will use Pipe Jack Tables or Pipe Racks.

#### **BELL HOLD WELD**

A **"bell hold"** weld is a weld made in a fixed vertical position with the pipe lying horizontally.

#### **BELL HOLE**

A **"bell hole"** is a term used where a hole is dug and you are going to weld pipe together in this hole (usually never big enough for a welder).

#### **BURN-THRU**

Blowing a hole in the pipe when welding is called a "*burn-thru*", difficult to repair.

#### WRAP AROUND OR ROUND ABOUT

A wrap around is a band (most of the time made from gasket material) about three inches wide, however, we made some from stainless steel. Used to wrap around pipe for marking cutting line. Sometimes called a – *"round-a-bout"*.

# (CONTINUED.) TERMINOLOGY

# FACE-UP

To **"face-up"** two pieces of pipe means to square the ends to where they come together all the way around or at least in three (3) places.

# CAN-TO-CAN

To weld "*can-to-can*" means to weld two sections of vessels together.

# PUT A HEAD ON VESSEL & WELL CAP

To put a head on a vessel means to weld the head to one end of the vessel. This is usually oval – or round-shaped. In piping, we call it a well cap.

## BACK WELD

Means welding from the inside of the pipe in a lot of cases where you have a lot of high-low and don't get a good stringer bead.

## TIE-IN

A *"tie-in"* is usually termed where two or more sections of pipe have been welded together and then you weld the two (2) sections together.

## COME-ALONG

A *"come-along"* is used some time to pull two pieces of pipe together for welding or sometimes to lift pipe into place.

# WEDGES, DOGS & LUGS

Some wedges and lugs are used to line up two sections of pipe or vessels for welding.

By welding a lug (sometimes called a "dog") on one section that is to be welded together letting one end of the dog reach over to the other section and driving a wedge underneath the lug will wedge the two pieces in line at that spot. The hazard is in knocking off the lugs after you get through with them and repairing the spot where the lugs were rewelded, very crude and rejected in a lot of places.

# BUTT WELD

A *"butt weld"* is where the pipe is butted together and welded. Sometimes a slip-on flange is put over the end of the pipe then welded inside and outside. No clamp is needed, but the two hole leveler/combination square will work real well.

# (CONTINUED.) TERMINOLOGY

# CHILL RING OR BACK UP RING

This is a small metal bar that fits inside of the pipe spanning the joint about half an inch on both sides. A *"chill ring"* or *"back up ring"* is sometimes used. This is to keep excess weld from flowing inside the pipe. Also to keep from blowing a hole in the pipe when making the first pass. It will also reduce the flow through pipe and create turbulence in the flow and provide a place for corrosion. Not used on gas or oil pipe.

## CUT-OUT

A "cut-out" is when it has been determined that the weld or fit-up is not up to specifications and they are told to cut the weld out and do it over. A small section of pipe is cut-out to do an inspection.

# EGG SHAPED (Out of Round)

An occurrence which sometimes happens with pipe. When the pipe is stacked or being handled the weight of the pipe pushes down and the lower pipe is pushed into an out-of-round shape.

## PUSHER

The foreman. Employed to exert an influence to promote another's interest in work or to stimulate activity.

## DOG-LEG

A fit-up term referring to something having an abrupt angle. Terminology meaning being crooked or bent like a dog's hind leg.

# CHAIN ALIGNMENT GENERAL DESCRIPTIONS

<u>Chain</u> – Reaches around the pipe to hold Main Block and Jack Bars onto the pipe to align pipe.

<u>Main Block</u> – Located on all **DEARMAN** Chain Clamps to utilize Slots and a Retainer Pin to hold chain around pipe and to hold the Dog and Clamp Fine Adjustment.

Fine Adjustment for Clamp Chain – Located on one end of Clamp Chain; used to draw the slack out of the Chain while on pipe for final tightness.

**<u>Retainer Pin</u>** – Located on the Main Block; inserted over Chain to stop Clamp from kicking up.

**Safety Pin** – Located on the Main Block; inserts through holes in Main Block over the Chain Dog as safety procedures to assure Chain Dog won't kick out.

**<u>Chain Dog</u>** – Located in Main Block; Dog is tripped to let out enough chain to allow clamp to go around different diameter pipes to lock chain in place after you pull all the slack out of the Chain Clamp.

# **Fine Adjustment for Clamp**

<u>Chain</u> – Located on one end of Clamp Chain; used to draw the slack out of the Chain while on pipe for final tightness.

<u>Jackbars</u> – Located on Clamp Chain; spaced evenly around pipe for proper support of fitting or pipe.

<u>Jackscrews</u> – Located on jackbars; used to remove the High-Low by screwing in only where high exists and to give precise alignment.

**<u>Spacing Tool</u>** – Located on jackbars; used to obtain proper spacing on each joint for welding bracket with pointed screws.

Leveling and Supporting Device – Incorporates a fine adjustment mechanism that allows precise squaring and spacing top and bottom and supports most all fittings by attaching to the pipe end and the fit up end.

**Hold Down Clamp** – Portable chain-like vice holds short pieces of pipe to table or pipe jacks. Keeps pipe from moving while fitups are being made.

**Locking Hook** – A self-locking latch on the Rim Type Clamp which locks clamp at bottom of pipe when clamp is moved in around the pipe.



Cat. No. D711 – 42"- 48" The Dearman Rim-Type Welding CLAMP *"In Action"* 



The Dearman Chain Type Welding Clamp For precision fit-up



THE DEARMAN SYSTEM WORKS Cat. No. D2249 – 4"-16"

Mathey Dearman Welding Clamps are the answer to any fit-up in the shop or in the field for vertical or horizontal applications.



Cat. No. D250 - 1"-8"

# STEP BY STEP USAGE OF CLAMPS AND ACCESSORY TOOLS

# INTRODUCTION:

The **Mathey DEARMAN System** is used with the following clamps and supporting tools.

- DEARMAN Hold Down Clamp. (Used in some cases.)
- DEARMAN Chain Type Welding Clamp.
- DEARMAN Level and Support Device.
- DEARMAN I.D. High-Low Gauge.
- DEARMAN Protractor.
- DEARMAN Rim-Type Reforming Clamp.

A description of each tool and instruction on how to use each tool is shown in logical order of their use throughout this chapter.



The DEARMAN D711 Rim Clamp

# THE DEARMAN METHOD OF HOLDING A PIPE DOWN TO INSURE A PROPER FIT

**Description:** The method of holding a pipe stationary while preparing for a fit-up is accomplished by using the Mathey DEARMAN Hold-Down Clamp. This Clamp consists of a Chain, Bracket, Hook, and Fine Adjustment Mechanism. The Hold-Down Clamp acts as a vice to securely hold the pipe onto a pipe-stand, table, or any stationary object used to rest the pipe. This Clamp may also be used, in some cases, to hold the leveling device to the fitting.



Cat. No D244 (2"-16") or D245 (10" - 16") Hold Down Clamp

# **INSTRUCTIONS FOR USE**

STEP 1. Let out the Fine Adjustment Mechanism all the way to allow for removal of the slack from the chain.



Cat. No. D244 & D245

**STEP 2.** Wrap the chain around the pipe and pipe stand, or other stationary object used to rest the pipe. Secure the chain as tight as you can into the hook on the Hold Down Clamp.



Cat. No. D244 & D245

STEP 3. The pipe is secured by tightening the Fine Adjustment on the Hold Down Clamp. USING THE MATHEY DEARMAN METHOD OF PREPARING FOR FIT-UP OF A FLANGE OR PIPE

> Before beginning the fit-up, be sure that bent and distorted pipe and edges are repaired. Grind or file off rust, paint, or slag. You are now prepared to start your fit-up.

**DESCRIPTION:** The Dearman System is used with the Chain Type Pipe Welding Clamp which consists of:

1. Main Block
2. Fine Adjustment Mechanism
3. Jack Bars and Screws
4. Spacing Screws
5. Chain

Fine Adjustment
Main Block
Main Block
Main Block
Jack Bars
and Screws
Spacing Screws
Chain
Chain
Chain
Cat. No. D250 –
1"- 8"

#### **Double Jackscrew Chain Clamp**

The Clamp is adjustable for over 100 fit-ups on a variety of pipe sizes and fittings, including Valves. Jackbars may be added or removed, as required, by removing the Chain Stop and the Main Block from the Chain and then sliding the Jackbar onto the Chain. Re-thread Chain through the Block and replace Chain Stop. **Remove** Jackbars in the same manner.



Cat. No. D250 – 1"- 8" Clamp Replaces 231-250-250HS

**STEP 1.** Remove the Mathey Dearman Chain Type Pipe Welding Clamp from its tool box and watch proper placement of hands on the Clamp. This makes it easier to install the Clamp around pipe and avoids the possibility of a pinched finger or hand. Let out enough chain slack to be sure you have plenty to go around pipe. Place the Clamp on the pipe with the Main Block at the top of the pipe.



Cat. No. D250



Cat. No. D250 1" - 8"

**STEP 2.** Place Fine Adjustment Assembly in the notches on the Main Block. Place Chain Lock Pin through the Main Block and over the chain.



Cat. No. D250 1" - 8"

**STEP 3.** Grasp the end piece of Chain with one hand while supporting the Fine Adjustment Crank with the other hand. Pull chain snuggly around the pipe.



Cat. No. D250-1"-8"

**STEP 4.** Place the Jackbars on each bottom quarter while holding in place with Thumbscrews. Jackbars should extend approximately one inch beyond the end of the pipe. Back off Jackscrews and Spacing Screws (sold separately) to provide room for fitting. If pipe or fitting is being handled with a machine, slide Jackbars back from end of the pipe until you get the other piece butted up. Then slide clamp forward until Jackscrews catch the piece to be fitted. This will avoid the pipe or fitting from banging the end of the Jackbars of the Clamp.

**NOTE:** It is also wise to use a piece of wood, 2 x 4, to keep the pipe or fitting from damaging the two bevels when they come together.



Cat. No. D250 1" - 8"

**STEP 5.** Take up the remaining slack in the Chain by turning the Fine Adjustment Crank clockwise. The Clamp is now ready to accept any pipe or fitting of the same size.



Cat. No. D250-1"-8"



Cat. No. D250 1" - 8"



# THE MATHEY DEARMAN SYSTEM OF SUPPORTING AND LEVELING A FLANGE DURING FIT-UP

**<u>DESCRIPTION</u>**: The Mathey Dearman Level and Support Device is an exclusive tool manufactured and furnished with most Mathey Dearman Chain Clamps.

The **Level and Support Device** supports the fitting. It allows a precise opening and closing of the gap at the top, between the fitting and the pipe. It will allow squaring and spacing of the fitting while it holds the fitting into the Chain Clamp. In the case of a flange fitting, the device is attached by means of one bolt through the bolt hole of the Flange. The device consists of a Fine Adjustment Crank, Chain, and a "C" Clamp. Use the "C" Clamp of the Level and Support Device to clamp on to a fitting other then flanges.



Cat. No. D2250 - 1" - 8"

# APPLICATION

**STEP 1.** Attach the Level and Support Device to the Flange with a bolt and nut. Place the Bolt through the Flange and the Bracket on the Level and Support Device. Install the Nut hand tight onto the Bolt.



Cat. No. D2250 – 1" – 8"

**STEP 2.** Place the fitting in the Clamp by resting the bottom of the Flange on the two lower Jackscrews of the Clamp. Make sure the Chain of the Level and Support Device is at the top of the fitting and hooked into the Chain Holder Ears of the Main Block. The device is now supporting your fitting. If you placed this fitting by hand you can now let go. This frees your hands for other work. If you have been using lifting equipment you can release your lifting equipment for other jobs while the fit-up is being made. If in your opinion you think the Level and Support Device will not fully support the fitting then leave your lifting equipment in place. The Level and Support Device will help give you the Fine Adjustment you need rather than depending 100% on your large lifting equipment. It will also help hold the fitting into the Welding Clamp for fit-up.



Cat. No. D2250 – 1" – 8"

**STEP 3.** If you didn't do this previously, place the chain of the Level and Support Device into the Chain Holder Ears of the Main Block. Leave <sup>3</sup>/<sub>4</sub> inch space between the top of the pipe and the flange.



Cat. No. D2250 - 1" - 8"

**STEP 4.** Turn the fine Adjustment Crank of the Level and Support Device until the flange is faced up – Touching the pipe all around, or at least in three places.



Cat. No. D2250 - 1" - 8"



**STEP 5.** Once a fitting has been faced up the next step is to remove the high-low out of the fit-up. High-low refers to the amount of difference in alignment of the inside wall of the fit-up.

# THE DEARMAN SYSTEM OF SUPPORTING AND LEVELING A FLANGE



No. D2250 1" - 8"

**STEP 1.** The Dearman Innovative Square Positioner, holding two (2) squares, is placed on top of the pipe behind the clamp. The face of the flange is checked with one leg of the Square while keeping the Square flush with the pipe.

**STEP 2.** The flange is squared top to bottom by tightening or loosening the Fine Adjustment Crank on the Level and Support Device. Another common method is to use a level or levels to check squareness prior to tack welding.



No. D2250 1" - 8"

**STEP 3.** Proper spacing between the flange and the pipe is accomplished with the Spacing Screws. These screws are mounted on movable brackets so that they can be centered between the fitting and the pipe. The screws are tightened to increase spacing; to reduce spacing, the screws are loosened. After the fitting has been squared and spaced, the top is tack welded.



Cat. No. D2250 1" - 8"

**STEP 4.** The alignment is again checked, since tacking can cause the fit-up to move.



Cat. No. D2250 1" - 8"

**STEP 5.** The bottom is tacked next. In addition to being square top to bottom, the fitting must be squared side to side.



Cat. No. D22250 1" - 8"

**STEP 6.** The side to side alignment is adjusted with spacing screws. Tack weld both sides.



Cat. No. D2250-1" - 8"

**STEP 7.** After tacking both, one final check is made of the alignment.



Cat. No. D2250-1" - 8"
**STEP 8.** Remove clamp by first loosening the Fine Adjustment Crank of the Level and Support Device.



Cat. No. D2250-1" - 8"

**STEP 9.** Next, remove the Chain of the Level and Support Device from the Chain Holder Ears of the Main Block.



Cat. No. D2250-1" - 8"

**STEP 10.** Remove the bolt holding the Level and Support Device to the flange.



Cat. No. DA-400

**STEP 11.** Loosen the Fine Adjustment Crank on the Clamp Main Block – remove the Chain Lock Pin.



Cat. No. DA-400

**STEP 12.** Lift the Fine Adjustment Assembly off of the Main Block – remove the clamp.



Cat. No. DA-400

**STEP 13.** These are the steps necessary in the fit-up of a pipe and flange. Many of the same techniques apply to the various size Mathey Dearman Pipe Welding Clamps.



## THE DEARMAN METHOD OF FITTING AN ELBOW IN THE "UP" POSITION

**NOTE:** The **DEARMAN Method** of securing your pipe in preparation for fit-ups as shown on pages 15 and 16 also applies to the following fit-ups of elbows and "T's", however, for fitting elbows and "T's" there is no change in using the Level and Support Device as noted below.

**STEP 1.** After mounting the DEARMAN Clamp on pipe, attach the Level and Support Device by means of the "C" Clamp to the inside of the Elbow. The bolt must be tightened firmly to avoid slipping.



Cat. No. D2250 - 1" - 8"

**STEP 2.** Grasp the fitting with both hands and place the Chain of the Level and Support Device between the thumb and the palm of one hand. By holding the chain in this manner, it is kept from between the pipe and the fitting. (Do not pick the fitting up with the Level and Support Device.) If the fitting is heavy and is moved by crane or lifting device, be sure to pick the fitting up so that the end will hang plum with the end of the pipe you are about to fit-up.



Cat. No. D2250 - 1" - 8"

STEP 3. Rest the elbow on the lower Jackscrews of the clamp.



Cat. No. D2250 - 1" - 8"

**STEP 4.** Place the Chain of the Level and Support Device into Chain Holder Ears of the Main Block. Leave <sup>3</sup>/<sub>4</sub>" of space between the top of the fitting and the pipe so that you will have room for adjustment.



Cat. No. D2250 - 1" - 8"

**STEP 5** The fitting is faced up by turning the Fine Adjustment Crank of the Level and Support device. Next, the highlow is removed from the fit-up. Remove the high-low by adjusting the Jackscrews. Use screws on the high spots only. (The proper spacing is then provided, and the pipe checked to make sure it is level.)



# THE DEARMAN METHOD OF FITTING AN ELBOW IN THE "DOWN" POSITION

**STEP 1.** After mounting the Dearman Clamp on the pipe, install the Level and Support Device. Lay the Level and Support Device on the back of the elbow.



Cat. No. D2250 - 1" - 8"

**STEP 2.** The Dearman Hold Down Clamp is then hooked over the "C" Clamp of the Level and Support Device Clamp to secure it to the elbow.



Cat. No. D244 / Cat No. 2250 — 1" – 8"

**STEP 3.** The elbow is positioned on the two lower Jackscrews and the Chain of the Level and Support Device is hooked in the Chain Holder Ears of the Main Block of the clamp.



Cat. No. D244 / Cat. No. D2250 – 1" – 8"



Cat. No. D244 / Cat No. 2250 — 1" – 8"

**STEP 4.** The fitting is faced up by turning the Fine Adjustment Crank on the Level and Support Device. Next, the highlow is removed from the fit-up. The proper spacing is then provided, and the pipe checked to make sure it is level.

#### THE DEARMAN METHOD OF FITTING A "T" IN LINE



No. D250 - 1" - 8"

**STEP 1.** After mounting the Dearman Clamp on pipe, install the Level and Support Device. Attach the "C" Clamp of the Level and Support Device to one end of the fitting. Tighten the bolt so that it does not slip off.



No. DA-400

**STEP 2.** Lift the fitting with both hands – place it on the two lower Jackscrews of the Jackbar – the Chain of the Level and Support Device should be at the top of the fitting.



Cat. No. D250- 1"-8"

**STEP 3.** Hook the Chain of the Level and Support Device into the Chain Holder Ears of the Main Block of the clamp. Face-up fitting by turning the Fine Adjustment Crank of the Level and Support Device.

Remove the high-low from the fit-up by adjusting the Jackbar Screws on the Clamp. Provide proper spacing with Spacing Screws. Check pipe to be sure it is level.



Cat. No. D250-1"-8"

#### THE DEARMAN METHOD OF FITTING A "T" IN THE PERPENDICULAR POSITION

**STEP 1.** After mounting the DEARMAN Clamp on pipe, install the Level and Support Device. The Level and Support Device is clamped to the top opening of the "T". With both hands, lift the fitting, keeping the chain of the Level and Support Device on top, and place the fitting on the two (2) lower Jackscrews of the Clamp.



1" – 8"

**STEP 2.** Hook the Chain of the Level and Support Device in the Chain Holder Ears of the Main Block. Face up the fitting by turning the Fine Adjustment Crank of the Level and Support Device.

Check the pipe to make sure it is level. Remove the high-low from the fit-up with the Jackscrews on the Clamp. Provide proper spacing between pipe and fitting with Spacing Screws.

#### THE DEARMAN METHOD OF FITTING THE "T" IN THE CROSSWAY POSITION

**STEP 1.** Place the Level and Support Device on top of the fitting. Place the chain of the Hold Down Clamp over the Level and Support Device.



Cat. No. D244 / --Cat. No. DA-400

**STEP 2.** Pull the Chain of the Hold Down Clamp through the fitting, hook and tighten the Hold Down Clamp around the Level and Support Device.



Cat. No. D244 / -Cat. No. DA-400

**STEP 3.** With both hands, lift the fitting and place it on the two (2) bottom Jackscrews of the Clamp.



Cat. No. D250 - 1" - 8" / Cat. No. 2441" - 8"



Cat. No. D250 - 1" - 8" / Cat. No. 244

**STEP 4.** Hook the Chain of the Level and Support Device into the Chain Holder Ears of the Main Block. Face-up fitting by adjusting the Fine Adjustment Crank on the Level and Support Device.

## THE DEARMAN SYSTEM OF FITTING VESSELS USING THE DEARMAN HEAVY DUTY D251 PIPE AND VESSEL CLAMP

**DESCRIPTION:** The Heavy Duty (Double Chain) Pipe and Vessel Clamp D251 is a flexible clamp with multiple jackbars and jackscrews. The size of the clamp is determined by the diameter of the vessel to be fit-up. The D251 Clamp eliminates the use of welded lugs and wedges. The D251 Clamp holds Vessel Heads and allows use of THE DEARMAN SYSTEM for fast, precision fit-ups, and eliminates welded lug cleanup time and grinder scars. THE DEARMAN SYSTEM of using the D251 Clamp gives you better weld quality.



Cat. No. D251 10'- 12'



Cat. No. D251 – 10"-36" Pipe to Pipe



Cat. No. D251 – 10"-36" Valve Fit-uP

# APPLICATION OF THE MATHEY DEARMAN SYSTEM OF FITTING VESSELS USING THE DEARMAN D251 VESSEL CLAMP

Repair any bent or distorted edges before beginning fit-up.

It is helpful to measure the diameter of each section you are fitting. This allows you to equally distribute the difference in diameter evenly all around the pipe.



1. Make sure all Jackscrews are backed out to clear Vessel.

2. Pick up Clamp on or near center, using one or two point suspension.

3. Raise Clamp over vessel, then lower Clamp over each side of Vessel.

4. Bring Main Block of Clamp under Vessel. The Fine Adjustment Mechanism should hang free at height convenient to work waist high. Let your adjustment all the way out of the Fine Adjustment Mechanism. Adjust the two Chains as close to the same length as you can. Adjust as much of the slack out of the Chains as you can before you latch the Fine Adjustment Mechanism in the notch of the Main Block.

5. Raise Block up to Crank and engage Crank Ears into Main Block notches, engage Chain Lock Pin over the Chain in the Main Block. Be sure Clamp is clear of the end so when you bring the other piece in it will not damage the Clamp.

6. Bring other section of Vessel into position and slide the Clamp over until end Jackscrews will set down on second section. (If you are working on shell to shell, you may want to work the fit-up between the two Chains.) In most cases the Jackbars will be more effective if you work on the end. Tighten the Fine Adjustment on Clamp to remove slack in Chain.

# (CONTINUED.) FITTING VESSELS

7. <u>Caution</u>: It should never be necessary to tighten all Jackscrews where highs exist. **Do Not: Attempt** to remove all the high-low the first time.

8. Tighten each needed Jackscrew a small amount at a time, go around the vessel enough times to remove the high-low until you have a good fit-up. We suggest you do not use more than one tack on Vessels before you complete the fit-up.

**9.** When possible, make a complete 360 degree weld on inside of Vessel before removing Clamp and welding the outside. This eliminates tacking. When inside welding is not possible, Jackbars are arranged to give 80 percent welding area when inside welding is not possible.

**10.** It is suggested that all unrestricted areas are welded before removing the clamp. This will normally prevent cracking or distortion. Back off all Jackscrews before removing Clamp.

## DEARMAN DOUBLE JACKSCREW CHAIN CLAMP



Cat. No. D250 - 1" -8"

The Dearman Double Jackscrew Chain Clamp's reputation is well deserved. This unique clamp was designed to give a significant advantage over most other clamps and other methods of fit-ups – Heliarc, acetylene, MIG and stick welds can be made on the entire weld area without removing the clamp. Only Dearman Clamps can offer this capability for external application of fit-up equipment.



Cat. No. D250 - 1" -8"

# **USA STANDARD**



HOIST- With forearm vertical. forefinger pointing up, move hand in small horizontal circles.



LOWER- With arm extended downward, forefinger pointing down, move hand in small horizontal circles.



USE MAIN HOIST- Tap fist on head; then use regular signals.







USE WHIPLINE- (Auxiliary Hoist). Tap elbow with one hand; then use regular signals.

RAISE BOOM- Arm extended, fingers closed, thumb pointing upward.

LOWER BOOM- Arm extended, fingers closed, thumbs pointing downward.



MOVE SLOWLY- Use one hand to give any motion signal and place other hand motionless in front of hand giving the motion signal.

THE LOAD- Arm extended, fingers closed, thumb pointing upward, other arm bent slightly with forefinger pointing down and (Hoist slowly shown as example.) rotate hand in horizontal circles.

RAISE THE BOOM AND LOWER LOWER THE BOOM AND RAISE THE LOAD- Arm extended, fingers closed, thumb pointing downward, other arm with forearm vertical, forefingerpointing upward and rotate hand in horizontal circles.

#### FIG. 1 STANDARD HAND SIGNALS FOR CONTROLLING CRANE OPERATIONS

# **CRAWLER, LOCOMOTIVE AND TRUCK CRANES**



SWING- Arm extended, point with finger in direction of the sides horizontally, fingers swing of boom.



EMERGENCY STOP- Arm

outstretched palm down-move outstretched. hand rapidly right and left.



TRAVEL (Both Tracks)- Use both fists in front of body, making a circular motion about each other. Indicating direction of travel; forward or backward. (For Crawler Cranes only.)



TRAVEL- Arm extended forward hand open and slightly raised, make pushing motion in direction of travel



DOG EVERYTHING- Clasp hands in front of body.



TRAVEL (One Track)- Lock the track on side indicated by raised fist. Travel opposite track in direction indicated by circular motion of other fist rotated vertically in front of body. (For crawler cranes only.)



EXTEND BOOM- (Telescoping Booms). Both fists in front of body with thumbs pointing outward. One hand signal may be used.



RETRACT BOOM- (Telescoping Booms). Both fists in front of body with thumbs pointing toward each other. One hand signal may be used.

#### FIG. 2 STANDARD HAND SIGNALS FOR CONTROLLING CRANE OPERATIONS.

# REVOLUTIONARY WELDERS WONDER



"RIM CLAMP" Cat. No. D711



Clamp being lowered onto a 24" Pipe.

# THE DEARMAN RIM-TYPE REFORMING WELDER'S ALIGNMENT CLAMP

**INTRODUCTION:** The Dearman Rim-type Reforming Clamp is designed to give you a full-circumference weld and grind without removing the Clamp. Only from this Clamp can you get the 100% weld area you need to keep the two joints from springing back, out of conformity to each other, cracking partial welds.

The Mathey Dearman Rim-Type Reforming Clamp will allow you to deliver 100% weld, grind and reweld before you have to remove the clamp.

Each clamp fits 2 to 6 sizes of pipe and fittings and comes in all sizes from 4" to 112" in diameter.

For quick and easy application, please study the following **INSTRUCTIONS FOR USE**.



Cat. No. D711 – 18" – 24"

### INSTRUCTIONS FOR USE – MATHEY DEARMAN RIM-TYPE REFORMING CLAMP CAT. NO. 711

**DESIGN:** The Dearman Rim-Type Reforming Clamp holds straight pipe and pipe fittings so that they can be welded. The clamp can also reform one section of pipe to match another section or to match a fitting.

The design of the clamp is such that the four flip-up Jackbars will stabilize the clamp on the pipe. The Jackscrews, placed around the clamp, can be tightened and loosened to shape the pipe to match the new piece that will be welded to it. The four front flip-up Jackbars are used to position and hold the second piece of pipe or fitting.



Cat. No. D711– 1824 / 18" – 24"

# **INSTRUCTION OF USE**

**STEP 1.** Unlatch Red Latch Hook. Lift clamp by using the chain with lifting mechanism which will open up clamp. This allows clamp to be lowered over pipe.



Cat. No. D711-1824 / 18" - 24"

**STEP 2.** Before the clamp is lowered onto the pipe, all Jackscrews are backed off except for the two located nearest the two top quarters of the clamp. These two Jackscrews help center the clamp.



Cat. No. D711-1824 / 18" - 24"

**STEP 3.** Lower the clamp onto the pipe. As the clamp is lowered, it closes and the Red Hook latches automatically.



Cat. No. D711-1824 / 18" - 24"

STEP 4. The Reforming Clamp is positioned on the pipe so that the front Jackbars extend approximately two (2) inches beyond the end of the pipe. These Jackbars will help support the mating pipe or fitting.



Cat. No. D711-1824 / 18" - 24"

**STEP 5.** Center the Clamp by adjusting one Jackscrew in each quarter.



Cat. No. D711-1824 / 18" - 24"

**STEP 6.** Adjust the Jackscrews in the four (4) back stabilizer Jackbars to help stabilize and square the clamp on the pipe. The two front bottom Jackscrews are adjusted so that both pieces of pipe will be approximately aligned.



Cat. No. D711-1824 / 18" - 24"

**STEP 7.** Place the two (2) upper Jackbars in the backward position by pinning them back so that the second piece of pipe or fitting can be placed on the lower Jackscrews.



Cat. No. D711-1824 / 18" - 24" 54

**STEP 8.** Lower your second piece of pipe or fitting into position. At this point, the pipe should be resting on the lower two Jackscrews of the clamp. Pin the upper two Jackbars in the down position. Now, use the Jackscrews of the upper and lower Jackbars to move or shift the pipe into alignment with the piece of pipe the clamp is on.



Cat. No. D711-1824 / 18" – 24"

**STEP 9.** Shape the piece of pipe to the identical shape of the mating piece of pipe using the Jackscrews on the Clamp, thereby leaving no high-low condition. This is done by using two (2) or three (3) Jackscrews on your high spots. Two (2) or three (3) Jackscrews are used to be certain that all the pressure is not on one (1) Jackscrew. Before trying to remove all the high-low, be sure to back off all Jackscrews where high-low does not exist. You may have to release and readjust Jackscrews on the high spots more than one time to give the metal a chance to level out.



Cat. No. D711-1824 / 18" – 24"

**STEP 10.** If you prefer, the Jackbars are designed so you can make a complete bead before you move Jackbars back for grinding, or weld enough pipe to keep the loose piece in place. Loosen the top and bottom Jackscrews and remove pins. Fold Jackbars back and pin.



**STEP 11.** Your entire weld is now exposed for completing the weld and grinding process without releasing the reforming clamp. This step eliminates any chance of fracture due to clamp release stress on an incomplete weld bead.

**No other external clamp will allow you to accomplish this.** Reducing your starts and stops highly increases your quality of weld. The weld should now be made to specification before removing the clamp from the pipe. If the clamp is removed before the proper welding and grinding is completed, the weld could crack requiring a repair or complete cutout.



Cat. No. D711-1824 / 18" - 24"

Cat. No. D711-1824 / 18" – 24"

**STEP 12.** Removing the Clamp – Back off all Jackscrews except the ones in each **UPPER QUARTER** of the clamp. **UNLATCH RED LATCH HOOK** by pulling the Chain attached to the Hook. Clamp is now ready to move to next fit-up.



Cat. No. D711-4248 / 42" - 48"



Cat. No. D711-1824 / 18" - 24"

# ACCESSORIES THE DEARMAN PIPE FITTER'S PROTRACTOR

# ADVANTAGES:

- Checks out area where pipe is to be installed.
- Lays out ditch lines fast, and accurate to any degree.
- Mates pipe to any desired degree.
- Can make layouts on flat surface.



Large Protractor – Cat. No. DK-100



Square – Cat. No. D248

# CHAIN CLAMP SPACING TOOL

**The "Chain Clamp Spacing Tool"** is a part of the Dearman, Inc., fine line of *"advanced tools and equipment serving the piping industry."* 

This fully adjustable Spacing Tool slides to the joint after the clamp has been tightened. A couple of turns of the heat-treated Spacing Screw and the gap is set for a perfect weld.

With the **"Spacing Tool"** only the Dearman pipe welding clamp will align over 100 fit-ups and eliminate the high-low, give exact gap spacing required at each joint for welding, saving time on welding and facilitating a much better weld.

Fully adjustable spacing tool slides to the joint allowing fast and accurate spacing.



**Jackbar Spacing Tool** 



Main Block (Universal) Jackbar) Spacing Tool

We are challenging anybody's equipment to compete with the Dearman Products for:

- Accuracy
- Versatility
- Durability
- Capability



All Dearman products are manufactured to meet the most exacting standards in the piping industry. Backed by years of practical field experience and engineering know how. Dearman products are built for long hard use. Precision engineered to be the finest and most useful tools available. You'll find Dearman tools on construction sites of nuclear power plants, gas and oil refineries, chemical plants, pipelines, pumping stations, ship yards, plumbing and heating companies and almost anywhere steel pipe needs welding.

Dearman Pipe and Vessel Clamps and Accessories for basic sizes adjust from 1" to over 20' in diameter.



1"-8" Dearman Pipe Welding Clamp adjust to fit 1" - 8". Fitting up T's, 90°, flanges, weld caps, etc. Doing over 100 different fit-ups.



Rim-Type Reforming Clamp Showing Jackbar folded back getting ready for 100% stringer bead, grinding room and rewelding without removing the clamp.



D251 Pipe and Vessel Clamp does all kinds of butt welds, fitting and pipe including vessel work over 20' in diameter. The picture shows 24" pipe to pipe fitup.



Large Protractor – Cat. No. DK-100



# NUCLEAR APPLICATIONS

The supply of energy throughout the world is becoming more critical. In 1976 the voters of many states in America mandated the safety of nuclear energy. There is no doubt that nuclear energy is well on its way to realizing its full potential.

We all know the construction of nuclear energy facilities have the most demanding regulations and specifications ever required. Dearman tools and equipment are ready to meet the challenge. The Dearman pipe clamps are available to meet stainless steel requirements. It is important to note that the Dearman clamp, for nuclear use, are manufactured with rigid quality standards to assure lasting use. Nuclear power constructors have accepted these clamps as their answer to performing the difficult task of stainless steel alignment and welding.

Dearman Clamps and equipment are recognized as the standard fitting procedure in stainless steel piping. It is of particular merit to note the Dearman Rim-Type Reforming Clamp is constructed so it does not need any additional parts to satisfy stainless steel requirements.

Dearman tools are designed to provide easier, faster and more accurate fit-ups, which result in greater reliability and integrity on the job. Safety is a constant by-word with Dearman tools – safety for the fitter, the welder and an end result of greater safety for the community and general public. In the construction of nuclear power plants, safety is always at the top of the priority list and this vital goal can be achieved whenever Dearman equipment is used on a job. It is with this thought in mind that Tim Dearman created the tools to meet the rigid nuclear construction requirements.

Other pages of this manual describe in detail the advantages mentioned here. As with all the other aspects of nuclear energy however, these advantages become more significant in this specialized application.

# RECOMMENDED USE OF DEARMAN CLAMPS

Alignment and reforming performance will depend directly on the condition of pipe and may vary from the recommended wall thickness. The clamp can align much thicker pipe that does not have to be reshaped and has been used on 4" thick pipe for aligning.

The Rim-Type Clamp is recommended where you have lots of outof-round and you need to get a full bead and grinding before you release the clamp.

Clamp	Cat. No.		Model No. Pipe Dia.	Wall Thickness	Reforming and Pipe Dia. Wall Thickness
	Double Jack Screw	Single Jack Screw			
DEARMAN Pipe Weld- ing Clamp	D250	D231	1" - 8"	Schedule 40	Reforming 3/16
	D249	D232	4" - 16"	Schedule 40	Reforming 1/4"
	D235	D233	10" - 36"	Schedule 40	Reforming 3/8"
	D236	D234	10" - 54"	Schedule 40	
DEARMAN Heavy -Duty Adjustable Reforming Clamp	D251		10" - 20'	Schedule 80	Reforming up to 1"
DEARMAN Rim Type Reforming Clamp	D711		4"-16" 16" and up	Schedule 40 Schedule 40	1/2" / 2"

# **RECOMMENDED USE OF DEARMAN CLAMPS**



## AT A GLANCE – COMMON SENSE MEANS THE DEARMAN SYSTEM

# A. Light Weight

1. 1"- 8'

Single Jackscrew weighs only 7 lbs. Double Jackscrew weighs only 17 lbs.

- 4"-16' Single Jackscrew weighs only 49 lbs. Double Jackscrew weighs only 44 lbs.
- 10" 36" Single Jackscrew weighs only 104 lbs. Double Jackscrew weighs only 109 lbs.
- 4. 10" 54"

Single Jackscrew weighs only 144 lbs. Double Jackscrew weighs only 152 lbs.

## **B. Simplicity**

- 1. Adjustable one size pipe to another in 2 minutes or less.
- 2. One clamp will do over 100 different fitups.

## C. Portable

- 1. Sturdy carrying case.
- 2. Easy to transport.
- 3. Compact storage.

### D. Accurate

- 1. Eliminates high-low.
- 2. Precision fit-ups.

# (CONTINUED.) AT A GLANCE

## E. Versatile

- 1. Will align valves as well as pipe and fittings
- 2. Works when using back-up rings.
- 3. Does many fit-ups no other tool is designed to do.

## F. Thrifty

- 1. Less expensive
- 2 Constructed for hard and continuous usage.
- 3. Cuts inventory costs.
- 4. Pipe usually culled can be saved.

#### G. Flexible

1. Can be used in vertical or horizontal.

### H. Specials

1. Can be purchased in Stainless Steel models.

### I. Safety

- By mechanically supporting fittings, it takes the back breaking tasks out of work.
- 2. No arc spatter burns and no danger to eyes.
- Clamp holds fitting to pipe, eliminating dropping or tack breaking and causing feet or leg injuries.
- Hammering of wedges eliminated which eliminates flying steel particles to the eyes and wedges popping out.
- 5. Fitter can turn his back on welder eliminating lash burn to eyes.
- 6. Mechanical support eliminates possibility of electrical shock.

# FEATURES AND BENEFITS OF PIPE WELDING ADJUSTABLE CLAMPS

### I. FEATURE – Most versatile clamp in pipe industry.

- A. Benefit:
  - One clamp for multiple uses: pipe to pipe; fittings to pipe; fittings to fittings.
  - Over 100 fit-ups on a variety of pipe sizes and fittings, including valves.
  - Allows more weld space than conventional clamps.
  - Portable for job site usage as well as in-shop use.
  - Back-up rings can be used, if desired.

### II. FEATURE – One clamp can be used for multiple pipe sizes. B. Benefit:

# Very economical compared to most clamps in that only three are needed for 2" through 20' pipe and fitting sizes.

- 1"- 8" Clamp 11 commercial pipe sizes.
- 4"-16" Clamp 8 commercial pipe sizes.
- 10"-36" Clamp 9 commercial pipe sizes.
- 10"-54" Clamp 14 commercial pipe sizes
- D251 Clamp 10" 20' pipe sizes

#### III. FEATURE – Additional Clamp Chain and Jackbars may be added to cataloged clamps for use on light wall pipe (and vessels).

### C. Benefit:

- 1"- 8" Clamp can be used on pipe and fitting sizes 1" through 8".
- 4"-16" Clamp can be used on pipe and fitting sizes 4" through 16".
- 10"-36" Clamp can be used on pipe and fitting sizes 10" through 36".
- 10"-54" Clamp can be used on pipe and fitting sizes 10" through 54".

# IV. FEATURE – Level and Support device.

## D. Benefit:

- Accurate alignment and leveling quickly and easily.
- Safety will eliminate burns, shocks, and injuries resulting from dropped pipe and/or fittings, etc. Lets the fitter turn his back to the welder so as to not get eye burn.
## (CONTINUED.) FEATURES AND BENEFITS

### V. FEATURE – Fast and accurate.

### E. Benefit:

- Can adjust from one pipe size to another in 5 seconds.
- Permits positive, steady alignment required for meeting exacting specifications.

# VI. FEATURE – Movable Jackbars containing corrosion and spatter proof jack screws.

### F. Benefits:

- Eliminates high-lows with pinpoint accuracy.
- Easy to adjust for proper pipe support regardless of pipe size.

### VII. FEATURE - Clamps include built-in spacing tool.

### G Benefit:

 Can adjust gap accurately and quickly with self-contained tool.

### VIII. FEATURE - Light weight

- Single Jackscrew 1"-8" clamp, 7 lbs.
- Double Jackscrew 1"-8" clamp, 17 lbs.
- Single Jackscrew 4"-16" clamp, 49 lbs.
- Double Jackscrew 4"-16" clamp, 44 lbs.

## H. Benefit:

• Able to carry up scaffolds or ladders, making clamp very portable for job site usage.

## IX. FEATURE - Can slide Jack Screw on either side of weld.

#### I. Benefit:

- Able to eliminate high-lows on either mating piece.
- Eliminates slippage of fittings.

## X. FEATURE – Clamps available for all sizes of Stainless

Steel Pipe. Clamp Chain, Jackbar Pads and Jack Screw Swivel Pads are non-magnetic stainless steel.

J. Benefit:

## PROCEDURE FOR APPLICATION OF BOLT TORQUE ON FLANGED JOINTS

# STEP 1. <u>Align component parts and clamp together</u> with Hold Down.

**STEP 2.** <u>Lubricate Stud</u> (or Bolt) Threads in area of Nut (or Forged Ring) Engagement. Also, <u>Iubricate</u> Face of Nuts (or Bolt Heads) using a suitable lubricant.

STEP 3. Install all Bolts and Nuts finger tight.

**STEP 4.** <u>Number Bolts</u> so that torquing requirements can be followed.

**STEP 5.** *Apply torque* in 20% (1/5) steps of required final torque, *loading* all Bolts at each step before proceeding to next step.

STEP 6. <u>Tighten Bolts</u> in sequential order 0-180°, 90°-270°, 45°-225° and 135°-315° at each step until final torque is reached. (See attached sketches.)

**STEP 7.** <u>Use rotational tightening</u> until all Bolts are stable at final torque level. (Two complete times around is usually required.) (See attached sketches on pages 69 to 71.)

# TORQUE REQUIRED TO PRODUCE

## BOLT DIAMETERS (IN)

Bolt Stress (PSI)	Mea- sured In	1/4	5/16	3/8	7/16	1/2	9/16	3/8	3/4	7/8	1
	ft. / Ibs.	0.133	0.267	0.400	0.667	1.000	1.500	2.000	3.333	5.333	8.167
1000	ft. / Ibs.	1.600	3.200	4.800	8.000	12.000	18.000	24.000	40.000	64.000	98.000
	ft. / Ibs.	0.266	0.534	0.800	1.334	2.000	3.000	4.000	6.666	10.666	16.334
2000	ft. / Ibs.	3.192	6.408	9.600	16.000	24.000	36.000	48.000	80.000	128.000	196.000
	ft. / Ibs.	0.399	0.801	1.200	2.001	3.000	4.500	6.000	9.999	15.999	24.501
3000	ft. / Ibs.	4.788	9.612	14.400	24.000	36.000	54.000	72.000	120.000	192.000	294.000
	ft. / Ibs.	0.532	1.068	1.600	2.668	4.000	6.000	8.000	13.332	21.332	32.668
4000	ft. / Ibs.	6.384	12.816	19.200	32.000	48.000	72.000	96.000	160.000	256.000	392.000
5000	ft. / Ibs.	0.665	1.335	2.000	3.335	5.000	7.500	10.000	16.665	26.665	40.835
5000	ft. / Ibs.	7.980	16.020	24.000	40.000	60.000	90.000	120.000	200.000	320.000	490.000
0000	ft. / Ibs.	0.798	1.602	2.400	4.002	6.000	9.000	12.000	19.998	31.998	49.002
0000	ft. / Ibs.	9.576	19.224	28.800	48.000	72.000	108.000	144.000	240.000	384.000	588.000
	ft. / Ibs.	0.931	1.869	2.800	4.669	7.000	10.500	14.000	23.331	37.331	57.169
7000	ft. / Ibs.	11.172	22.428	33.600	56.000	84.000	126.000	168.000	280.000	448.000	686.000
	ft. / Ibs.	1.064	2.136	3.200	5.336	8.000	12.000	16.000	26.664	65.336	65.336
8000	ft. / Ibs.	12.768	25.630	384.000	64.000	96.000	144.000	192.000	320.000	784.000	784.000
0000	ft. / Ibs.	1.197	2.403	3.600	6.003	9.000	13.500	18.000	29.997	47.997	73.503
9000	ft. / Ibs.	14.364	28.836	43.200	72.000	108.000	162.000	216.000	360.000	576.000	\
10000	ft. / Ibs.	1.330	2.670	4.000	6.670	10.000	15.000	20.000	33.330	53.330	81.670
10000	ft. / Ibs.	15.960	32.040	48.000	80.000	120.000	180.000	240.000	400.000	640.000	\
00000	ft. / Ibs.	2.660	5.340	8.000	13.340	20.000	30.000	40.000	66.660	106.660	163.340
20000	ft. / Ibs.	31.920	64.080	96.000	160.000	240.000	360.000	480.000	800.000	\	\
	ft. / Ibs.	3.990	8.010	12.000	20.010	30.000	45.000	60.000	99.990	159.990	245.010
30000	ft. / Ibs.	47.880	96.120	144.000	240.000	360.000	540.000	720.000	\	١	١
40000	ft. / Ibs.	5.320	10.680	16.000	26.680	40.000	60.000	80.000	133.320	213.320	326.680
40000	ft. / Ibs.	63.840	128.160	192.000	320.000	480.000	720.000	\	\	١	\
	ft. / Ibs.	6.650	13.350	20.000	33.350	50.000	75.000	100.000	166.650	266.650	408.350
50000	ft. / Ibs.	79.800	160.200	240.000	400.000	600.000	1	\	\	١	\
	ft. / Ibs.	7.980	16.020	24.000	40.020	60.000	90.000	120.000	199.980	319.980	490.020
60000	ft. / Ibs.	95.760	192.240	288.000	480.000	720.000	1	\	\	١	\

# **INDICATED BOLT STRESS**

## BOLT DIAMETERS (IN)

Bolt Stress PSI	Mea- sured In	1 1/8	11/4	13/8	1 1/2	15/8	13/4	17/8	2	21/4	21/2	2 3/4	3
1000	ft. / Ibs.	11.838	16.667	22.667	26.667	36.667	50.000	66.667	73.333	106.667	146.667	197.333	257.330
1000	ft./lbs.	142.000	200.000	272.000	320.000	800.000	600.000	800.000	/	/	/	1	/
0000	ft./lbs.	23.666	33.334	45.334	53.334	133.334	100.000	133.334	146.666	213.334	293.334	394.666	514.666
2000	ft./lbs.	285.000	400.000	544.000	640.000	/	/	/	/	/	/	/	/
3000	ft./lbs.	35.499	50.001	68.001	80.001	110.001	150.000	200.001	219.999	320.001	440.001	591.999	771.999
0000	ft. / Ibs.	426.000	600.000	/	/	/	/	/	1	/	/	1	/
4000	ft. / Ibs.	47.332	66.668	90.668	106.668	146.680	200.000	266.668	293.332	426.668	586.668	789.332	1029.332
4000	ft. / Ibs.	568.000	800.000	/	/	/	/	/	/	/	/	/	/
5000	ft./lbs.	59.165	83.335	113.335	133.335	183.335	250.000	333.335	366.665	533.335	733.335	986.665	1286.665
5000	ft. / Ibs.	710.000	/	/	/	/	/	/	/	/	/	/	/
0000	ft. / Ibs.	70.998	100.002	136.002	160.002	220.002	300.000	400.002	439.998	640.002	880.002	1183.998	1543.998
6000	ft. / Ibs.	/	/	/	/	/	/	/	/	/	/	/	/
	ft. / Ibs.	82.831	116.669	158.669	186.669	256.669	350.000	466.669	513.331	746.669	1026.669	1381.331	1801.331
7000	ft. / Ibs.	/	/	/	/	/	/	/	/	/	/	/	/
0000	ft. / Ibs.	94.664	133.336	181.336	213.330	293.336	400.000	533.336	586.664	853.336	1173.336	1578.664	2058.664
8000	ft. / Ibs.	/	/	/	/	/	/	/	/	/	/	/	/
0000	ft. / Ibs.	106.997	150.003	204.003	330.003	330.003	450.000	600.003	659.997	690.003	1320.003	1775.997	2315.997
9000	ft. / Ibs.	/	/	/	/	/	/	/	/	/	/	/	/
	ft. / Ibs.	118.330	166.670	226.670	266.670	366.670	500.000	666.670	733.330	1066.670	1466.670	1973.330	2513.330
10000	ft. / Ibs.	/	/	/	/	/	/	/	/	/	/	/	/
00000	ft. / Ibs.	236.660	333.340	453.340	533.340	733.340	1000.000	1333.340	1466.660	2133.340	2933.340	3946.660	5146.660
20000	ft. / Ibs.	/	/	/	/	/	/	/	/	/	/	/	/
	ft. / Ibs.	354.990	500.010	680.010	800.010	1100.010	1500.000	2000.010	2199.990	3200.010	4400.010	5919.990	7719.990
30000	ft. / Ibs.	/	/	/	/	/	/	/	/	/	/	/	/
40000	ft./lbs.	473.320	666.680	906.680	1066.680	1466.680	2000.000	2666.680	2933.320	4266.680	5866.680	7893.320	10293.320
40000	ft./lbs.	/	/	/	/	/	/	/	/	/	/	/	/
50000	ft. / Ibs.	591.650	833.350	1133.350	1333.350	1833.350	2500.000	3333.350	3666.650	5333.350	7333.350	9866.650	12866.650
50000	ft./lbs.	/	/	/	/	1	/	/	1	1	/	/	/
	ft. / Ibs.	709.980	1000.000	1360.020	1600.020	2200.020	3000.000	4000.020	4399.980	6400.020	8800.020	11839.980	15429.980
60000	ft. / Ibs.	/	/	/	/	/	/	/	/	/	/	/	/





SEQUENCIAL	ROTATIONAL
ORDER	ORDER
1-2	1
3-4	5
5-6	3
7-8	7
	2
	6
	4
	8









#### (CONTINUED.) CONVERSION FACTORS



## (CONTINUED.) CONVERSION FACTORS

## Minutes Converted to Decimals of a Degree

	<b>DE0</b>				550		550		<b>DE0</b>	MAINI	
MIN.	DEG.	MIN.	DEG.	MIN.	DEG.	MIN.	DEG.	MIN.	DEG.	WIIN.	DEG.
1	0.0166	11	0.1833	21	0.3500	31	0.5166	41	0.6833	51	0.8500
2	0.0333	12	0.2000	22	0.3666	32	0.5333	42	0.7000	52	0.8666
3	0.0500	13	0.2166	23	0.3833	33	0.5500	43	0.7166	53	0.8833
4	0.0666	14	0.2333	24	0.4000	34	0.5666	44	0.7333	54	0.9000
5	0.0833	15	0.2500	25	0.4166	35	0.5833	45	0.7500	55	0.9166
6	0.1000	16	0.2666	26	0.4333	36	0.6000	46	0.7666	56	0.9333
7	0.1166	17	0.2833	27	0.4500	37	0.6166	47	0.7833	57	0.9500
8	0.1333	18	0.3000	28	0.4666	38	0.6333	48	0.8000	58	0.9666
9	0.1500	19	0.3166	29	0.4833	39	0.6500	49	0.8166	59	0.9833
10	0.1666	20	0.3333	30	0.5000	40	0.6666	50	0.8333	60	1.0000

# **Decimal Equivalents of Fractions**

INCHES	DECIMAL OF AN INCH	INCHES	DECIMAL OF AN INCH
1/64	0.015625	7/16	0.4375
1/32	0.03125	29/64	0.453125
3/64	<b>0.0</b> 46875	15/32	0.46875
1/20	0.05	31/64	0.484375
1/16	0.0625	1/2	0.50
1/13	0.076923	33/64	0.515625
5/64	0.078125	17/32	0.53125
1/12	0.083333	35/64	0.546875
1/11	0.090909	9/16	0.5625
3/32	0.09375	37/64	0.578125
1/10	0.10	19/32	0.59375
7/64	0.109375	5/8	0.625
1/9	0.111111	41/64	0.640625
1/8	0.125	21/32	0.65625
9/64	0.140625	43/64	0.671875
1/7	0.142857	11/16	0.6875
5/32	0.15625	45/64	0.703125
1/6	0.166667	23/32	0.71875
11/64	0.171875	47/64	0.734375
3/16	0.1875	3/4	0.75
1/5	0.20	49/64	0.765625
13/64	0.203125	25/32	0.78125
7/32	0.21875	51/64	0.796875
15/64	0.234375	13/16	0.8125
1/4	0.25	53/64	0.828125
17/64	0.265625	27/32	0.84375
9/32	0.28125	55/64	0.859375
19/64	0.296875	7/8	0.875
21/64	0.3125	07/04 20/32	0.890625
1/3	0.333333	59/64	0.921875
11/32	0.34375	15/16	0.9375
23/64	0.359375	61/64	0.953125
3/8	0.375	31/32	0.96875
25/64	0.390625	63/64	0.984375
13/32	0.40625	1	1.0
27/64	0.421875		

#### (CONTINUED.) CONVERSION FACTORS Water Pressure to Feet Head

POUNDS PER SQUARE INCH	FEET HEAD	POUNDS PER SQUARE INCH	FEET HEAD
1	2.31	100	230.90
2	4.62	110	253.98
3	6.93	120	277.07
4	9.24	130	300.16
5	11.54	140	323.25
6	13.85	150	346.34
7	16.16	160	369.43
8	18.47	170	392.52
9	20.78	180	415.61
10	23.09	200	461.78
15	34.63	250	577.24
20	46.18	300	692.69
25	57.72	350	808.13
30	69.27	400	922.58
40	92.36	500	1154.48
50	115.45	600	1385.39
60	138.54	700	1616.30
70	161.63	800	1847.20
80	184.72	900	2078.10
90	207.81	1000	2309.00

**NOTE:** One pound of pressure per square inch of water equals 2.309 feet of water at 62° Fahrenheit. Therefore, to find the feet head of water for any pressure not given in the table above, multiply the pressure pounds per square inch by 2.309.

Feet Head of Water to PS
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POUNDS PER SQUARE INCH	FEET HEAD	POUNDS PER SQUARE INCH	FEET HEAD
1	0.43	100	43.31
2	0.87	110	47.64
3	1.30	120	51.97
4	1.73	130	56.30
5	2.17	140	60.63
6	2.60	150	64.96
7	3.03	160	69.29
8	3.46	170	73.63
9	3.90	180	77.96
10	4.33	200	86.62
15	6.50	250	108.27
20	8.66	300	129.93
25	10.83	350	151.58
30	12.99	400	173.24
40	17.32	500	216.55
50	21.65	600	259.85
60	25.99	700	303.16
70	30.32	800	346.47
80	34.65	900	389.78
90	38.98	1000	433.00

**NOTE:** One foot of water at 62° Fahrenheit equals .433 pound pressure per square inch. To find the pressure per square inch for any feet head not given in the table above, multiply the feet head by .433.

#### (CONTINUED.) CONVERSION FACTORS



## (CONTINUED.) CONVERSION CONSTANTS

## **Conversion Constants**

TO CHANGE	то	MULTIPLY BY
Inches	Feet	0.0833
Inches	Millimeters	25.4
Feet	Inches	12
Feet	Yards	0.3333
Yards	Feet	3
Square Inches	Square Feet	0.00694
Square Feet	Square Inches	144
Square Feet	Square Yards	0 11111
Square Yards	Square Feet	9
Qubic Inches	Cubic Feet	0 00058
Cubic Feet	Cubic Inches	1728
Cubic Feet	Cubic Yards	0.03703
Cubic Yards	Cubic Feet	27
Cubic Inches	Gallons	0.00433
Cubic Feet	Gallons	7 48
Gallons	Cubic Inches	231
Gallons	Cubic Inches	0 1227
Callons		0.1337
Bounds of Water	Gallons	0.33
Ounces	Pounds	0.12004
Pounds of Water	Ounces	16
Inches of Water	Pounds per square inch	0.0361
Inches of Water	Inches of Mercury	0.0735
Inches of Water	Ounces per square inch	0.578
Inches of Water	Pounds per square foot	5.2
Inches of Mercury	Inches of Water	13.6
Inches of Mercury	Feet of Water	1.1333
Inches of Mercury	Pounds per square inch	0.4914
Ounces per square inch	Inches of Mercury	0.127
Ounces per square inch	Inches of Water	1.733
Pounds per square inch	Inches of Water	27.72
Pounds per square inch	Feet of Water	2.31
Pounds per square inch	Inches of Mercury	2.04
Pounds per square inch	Atmospheres	0.0681
Feet of Water	Pounds per square inch	0.434
Feet of Water	Pounds per square foot	62.5
Feet of Water	Inches of Mercury	0.8824
Atmospheres	Pounds per square inch	14.696
Atmospheres	Inches of Mercury	29.92
Atmospheres	Peet of water	34 2240
Short Tons	Pounds	2240
Short Tons	Long Tons	0.89285

## EQUIVALENTS MILLIMETER EQUIVALENT

PIPE SIZES Inches = MM	PIPE SIZES Inches = MM
1" = 25.40	52" = 1320.80
2" = 50.80	54" = 1371.60
4" = 101.60	56" = 1422.40
6" = 152.40	58" = 1473.20
8" = 203.20	60" = 1524.00
10" = 254.00	62" = 1574.80
12" = 304.80	64" = 1625.60
14" = 355.60	66" = 1676.40
16" = 406.40	68" = 1727.20
18" = 457.20	70" = 1778.00
20" = 508.00	72" = 1828.80
22" = 558.80	74" = 1879.60
24" = 609.60	76" = 1930.40
26" = 660.40	78" = 1891.20
28" = 711.20	80" = 2032.00
30" = 762.00	82" = 2082.80
32" = 812.80	84" = 2133.60
34" = 863.60	86" = 2184.80
36" = 914.40	88" = 2235.20
38" = 965.20	90" = 2286.00
40" = 1016.00	92" = 2336.80
42" = 1066.80	94" = 2387.60
44" = 1117.60	96" = 2438.40
46" = 1168.40	98" = 2489.20
48" = 1219.20	100" = 2540.00
50" = 1270.00	

## (CONTINUED.) EQUIVALENTS

CENTIMETERS EQUIVALENT TO FEET					
FT. CM	FT. CM				
1' = 30	26' = 792				
2' = 61	27' = 823				
3' = 91	28' = 853				
4' = 122	29' = 884				
5' = 152	30' = 914				
6' = 183	31' = 945				
7' = 213	32' = 975				
8' = 244	33' = 1006				
9' = 274	34' = 1036				
10' = 305	35' = 1067				
11' = 335	36' = 1097				
12' = 366	37' = 1128				
13' = 396	38' = 1158				
14' = 427	39' = 1189				
15' = 457	40' = 1219				
16' = 488	41' = 1250				
17' = 518	42' = 1280				
18' = 549	43' = 1311				
19' = 579	44' = 1341				
20' = 610	45' = 1372				
21' = 640	46' = 1402				
22' = 671	47' = 1433				
23' = 701	48' = 1463				
24' = 732	49' = 1494				
25' = 762	50' = 1524				

## FEET EQUIVALENT TO METERS Approximate

FT. METER	FT. METER
1' = .30	26' = 7.93
2' = .61	27' = 8.23
3' = .91	28' = 8.53
4' = 1.22	29' = 8.84
5' = 1.52	30' = 9.14
6' = 1.83	31' = 9.45
7' = 2.13	32' = 9.75
8' = 2.44	33' = 10.06
9' = 2.74	34' = 10.36
10' = 3.06	35' = 10.67
11' = 3.35	36' = 10.97
12' = 3.66	37' = 11.28
13' = 3.96	38' = 11.58
14' = 4.27	39' = 11.89
15' = 4.57	40' = 12.19
16' = 4.88	41' = 12.50
17' = 5.18	42' = 12.80
18' = 5.47	43' = 13.10
19' = 5.79	44' = 13.41
20' = 6.10	45' = 13.72
21' = 6.40	46' = 14.02
22' = 6.71	47' = 14.33
23' = 7.01	48' = 14.63
24' = 7.32	49' = 14.94
25' = 7.60	50' = 15.24

## (CONTINUED.) CONVERSION FACTORS

#### COMMON EQUIVALENTS AND CONVERSION FACTORS (Approximate Common Equivalents)

1	inch	= 25 milimeters
1	foot	= 0.3 meter
1	yard	= 0.9 meter
1	mile	= 1.6 kilometers
1	square inch	= 6.5 square centimeters
1	square foot	= 0.09 square meter
1	square yard	= 0.8 square meter
1	acre	= 0.4 hectare +
1	cubic inch	= 16 cubic centimeters
1	cubic foot	= 0.03 cubic meter
1	cubic yard	= 0.8 cubic meter
1	gallon	= 0.004 cubic meter
1	ounce (avdp)	= 28 gram
1	pound	= 0.45 kilogram
1	horsepower	= 0.75 kilowatt
1	meter	= 3.3 feet
1	meter	= 1.1 yards
1	kilometer	= 0.6 mile (statute)
1	square centimeter	= 0.16 square inch
1	square meter	= 11 square feet
1	square meter	= 1.2 square yards
1	hectare +	= 2.5 acres
1	cubic centimeter	= 0.06 cubic inch
1	cubic meter	= 35 cubic feet
1	cubic meter	= 1.3 cubic yards
1	cubic meter	= 264 gallons
1	gram	= 0.035 ounce (avdp)
1	kilogram	= 2.2 pounds (avdp)

SOURCE: National Bureau of Standard Wall Chart

#### (CONTINUED.) CONVERSION FACTORS

#### COMMON EQUIVALENTS AND CONVERSION FACTORS FOR U.S. CUSTOMARY AND SI SYSTEM (Conversions Accurate to Parts per Million)

inches x 25.4\* feet x 0.3048\* vards x 0.9144\* mile x 1.60934 square inches x 6.4516\* square feet x 0.0929030 acres x 0.404686 cubic inches x 16 3871 cubic feet x 0.0283168 cubic yards x 0.764555 quarts (liq) x 0.946353 gallons x 0.00378541 ounces (avdp) x 28.3495 pounds (avdp) x 0.453592 horsepower x 0.745700 millimetres x 0.0393701 metres x 3.28084 metres x 1.09361 kilometres x 0.621371 square centimetres x 0.155000 square metres x 10.7639 square metres x 1.19599 hectares x 2,47105 cubic centimetres x 0.0610237 cubic metres x 35.3147 cubic metres x 1.30795 litres x 1.05669 cubic metres x 264,172 grams x 0.0352740 kilograms x 2.20462 kilowatts x 1.34102

- = millimetres
- = metres
- = metres
- = kilometres
- = square centimetres
- = square metres
- = hectares
- = cubic centimetres
- = cubic metres
- = cubic metres
- = litres
- = cubic metres
- = grams
- = kilograms
- = kilowatts
- = inches
- = feet
- = yards
- = miles (statute)
- = square inches
- = square feet
- = square yards
- = acres
- = cubic inches
- = cubic feet
- = cubic yards
- = quarts (liq)
- = gallons
- = ounces (avdp)
- = pounds (avdp)
- = horsepower

\*Exact

# WELDING FITTING DIMENSIONS







		W	ALL TH	IICKNE	90° ELBOWS		
NOM PIPE SIZE	OD	ST	XS	160	хх	LONG R	SHORT R *A
1/2	0.840	0.109	0.147	-	-	1 1/2	-
3/4	1.050	0.113	0.154	-	0.308	1 1/8	-
1	1.315	0.133	0.179	0.250	0.358	1 1/2	1
1 1/4	1.660	0.140	0.191	0.250	0.382	1 7/8	1 1/4
1 1/2	1.900	0.145	0.200	0.281	0.400	2 1/4	1 1/2
2	2.375	0.154	0.218	0.344	0.436	3	2
2 1/2	2.875	0.203	0.276	0.375	0.552	3 3/4	2 1/2
3	3.500	0.216	0.300	0.438	0.600	4 1/2	3
3 1/2	4.000	0.226	0.318	-	0.636	5 1/4	3 1/2
4	4.500	0.237	0.337	0.531	0.674	6	4
5	5.563	0.258	0.375	0.625	0.750	7 1/2	5
6	6.625	0.280	0.432	0.719	0.864	9	6
8	8.625	0.322	0.500	0.906	0.875	12	8
10	10.750	0.365	0.500	1.125	1.000	15	10
12	12.750	0.375	0.500	1.312	1.000	18	12
14	14.000	0.375	0.500	-	-	21	14
10	18.000	0.375	0.500		-	24	10
20	20.000	0.375	0.500	-	-	30	20
22	22.000	0.375	0.500	-	-	33	-
24	24.000	0.375	0.500	-	-	36	24
26	26.000	0.375	0.500	-	-	39	-
30	30.000	0.375	0.500	-	-	45	30
34	34.000	0.375	0.500	-	-	51	-
36	36.000	0.375	0.500		-	54 63	36 42
74	72.000	0.075	0.000	-	_	00	74



LONG R K	SHORT R K	В	с	E	с	F	G
1 15/16	-	5/8	1	1	-	3	1 3/8
1 11/16	-	7/16	1 1/8	1 1/4	-	3	1 11/16
2 3/16	1 5/8	7/8	1 1/2	1 1/2	-	4	2
2 3/4	2 1/16	1	1 7/8	1 1/2	1 7/8	4	2 1/2
3 1/4	2 7/16	1 1/8	2 1/4	1 1/2	2 1/4	4	2 7/8
4 3/16	3 3/16	1 3/8	2 1/2	1 1/2*	2 1/2	6	3 5/8
5 3/16	3 15/16	1 3/4	3	1 1/2*	3	6	4 1/8
6 1/4	4 3/4	2	3 3/8	2*	3 3/8	6	5
/ 1/4	5 1/2	2 1/4	3 3/4	2 1/2*	3 3/4	6	5 1/2
8 1/4	6 1/4	2 1/2	4 1/8	2 1/2^	4 1/8	6	6 3/16
10 5/16	7 3/4	3 1/8	4 7/8	3*	4 7/8	8	7 5/16
12 5/16	9 5/16	3 3/4	5 5/8	3 1/2*	5 5/8	8	8 1/2
16 5/16	12 5/16	5	7	4*	7	8	10 5/8
20 3/8	15 3/8	6 1/4	8 1/2	5*	8 1/2	10	12 3/4
24 3/8	18 3/8	/ 1/2	10	6^	10	10	15
28	21	8 3/4	11	6 1/2*	11	12	16 1/4
32	24	10	12	7*	12	12	18 1/2
36	27	11 1/4	13 1/2	8* 0*	13 1/2	12	21
40	30	12 1/2	15	9 <sup>°</sup>	15	12	23
44	-	13 1/2	16 1/2	10	16 1/2	-	-
48	36	15	17	10 1/2	17	12	27 1/4
52	-	16	19 1/2	10 1/2	19 1/2	-	-
60	45	18 1/2	22	10 1/2	22	-	-
-	-	21	25	10 1/2	25	-	-
-	54	22 1/2	26 1/2	10 1/2	-	-	-
-	-	-	-	12	-	-	-

\*Exact

NOM PIPE SIZE		н	с	м	
16X	6 8 10	- 14 14	12 12 12	10 3/8 10 3/4 11 1/8	
	12 14	14 14	12 12	11 5/8 12	
18¥	10 12	- 15 15	13 1/2 13 1/2 13 1/2	12 1/8 12 5/8	
	14 16	15 15	13 1/2 13 1/2	13 13	
	8 10	-	15 15	12 3/4 13 1/8	
20X	12 14 16	20 20 20	15 15 15	13 5/8 14 14	
	18 10	- 20	15 16 1/2	14 1/2 14 1/8	
	12 14 16	20	16 1/2 16 1/2 16 1/2	14 5/8 15 15	
228	18 20	20 20 20	16 1/2 16 1/2	15 1/2 16	
	10 12		17 17	15 1/8 15 5/8	
24X	14 16 18	20 20	17 17 17	16 16 16 1/2	
	12 14		19 1/2 19 1/2	17 16 5/8 17	
26X	16 18	- 24	19 1/2 19 1/2	17 17 1/2	
	20 22 24	24 24 24	19 1/2 19 1/2 19 1/2	18 18 1/2 19	
	14 16	-	22 22	19 19	
	18 20	24	22 22	19 1/2 20	
30X	22 24 26	24 24 24	22 22 22	20 1/2 21 21 1/2 21 1/2	
	16 18	-	25 25	21 21 21 1/2	
	20 22	-	25 25	22 22 1/2	
34X	24 26	24 24	25 25 25	23 23 1/2 23 1/2	
	30 32	24 24	25 25 25	24 24 24 1/2	
	16 18	-	26 1/2 26 1/2 26 1/2	22 22 1/2	
	20 22 24	- 24	26 1/2 26 1/2 26 1/2	23 23 1/2 24	
36X	26 28	24	26 1/2 26 1/2	24 1/2 24 1/2	
	30 32 34	24 24 24	26 1/2 26 1/2 26 1/2	25 25 1/2 26	
	24 26	24 24	-	- -	
42X	30 32	24 24 24	-	-	
	36	24	-	-	



		CONCENTRIC AND ECCENTRIC REDUCERS		JCING ET TEES
NOM PI	PE SIZE	н	с	м
1/2 X	1/4 3/8	-	1	1
3/4 X	3/8	1 1/2 1 1/2	1 1/8 1 1/8	1 1/8
1 X	3/8 1/2 3/4	2 2 2	1 1/2 1 1/2 1 1/2	1 1/2 1 1/2 1 1/2
1 1/4 X	1/2 3/4 1	2 2 2	1 7/8 1 7/8 1 7/8	1 7/8 1 7/8 1 7/8
1 1/2 X	1/2 3/4 1 1 1/4	2 1/2 2 1/2 2 1/2 2 1/2 2 1/2	2 1/4 2 1/4 2 1/4 2 1/4 2 1/4	2 1/4 2 1/4 2 1/4 2 1/4 2 1/4
2 X	3/4 1 1 1/4 1 1/2	3 3 3 3	2 1/2 2 1/2 2 1/2 2 1/2 2 1/2	1 3/4 2 2 1/4 2 3/8
2 1/2 X	1 1 1/4 1 1/2 2	3 1/2 3 1/2 3 1/2 3 1/2 3 1/2	3 3 3 3	2 1/4 2 1/2 2 5/8 2 3/4
3 X	1 1 1/4 1 1/2 2 2 1/2	- 3 1/2 3 1/2 3 1/2 3 1/2 3 1/2	3 3/8 3 3/8 3 3/8 3 3/8 3 3/8 3 3/8	2 5/8 2 3/4 2 7/8 3 3 1/4
3 1/2 X	1 1/4 1 1/2 2 2 1/2 3	4 4 4 4	- 3 3/4 3 3/4 3 3/4 3 3/4 3 3/4	- 3 1/8 3 1/4 3 1/2 3 5/8
4 X	1 1/2 2 2 1/2 3 3 1/2	4 4 4 4	4 1/8 4 1/8 4 1/8 4 1/8 4 1/8 4 1/8	3 3/8 3 1/2 3 3/4 3 7/8 4
5 X	2 2 1/2 3 3 1/2 4	5 5 5 5 5	4 7/8 4 7/8 4 7/8 4 7/8 4 7/8 4 7/8	4 1/8 4 1/4 4 3/8 4 1/2 4 5/8
6 X	2 1/2 3 3 1/2 4 5	5 1/2 5 1/2 5 1/2 5 1/2 5 1/2 5 1/2	5 5/8 5 5/8 5 5/8 5 5/8 5 5/8 5 5/8	4 3/4 4 7/8 5 5 1/8 5 3/8
8 X	3 3 1/2 4 5 6	- 6 6 6	7 7 7 7 7	6 6 1/8 6 3/8 6 5/8
10 X	4 5 6 8	7 7 7 7	8 1/2 8 1/2 8 1/2 8 1/2 8 1/2	7 1/4 7 1/2 7 5/8 8
12 X	5 6 8 10	8 8 8 8	10 10 10 10	8 1/2 8 5/8 9 9 1/2
14 X	6 8 10 12	13 13 13	11 11 11 11	9 3/8 9 3/4 10 1/8 10 5/8

N	OM PIPE SIZE	н	с	м	
	6	-	12	10 3/8	
	8	14	12	10 3/4	
16X	10	14	12	11 1/8	
	12	14	12	11 5/8	
	14	14	12 1/2	11 3/4	
	10	15	13 1/2	12 1/8	
197	12	15	13 1/2	12 5/8	
100	14	15	13 1/2	13	
	16	15	13 1/2	13	
	8	-	15	12 3/4	
	10	-	15	13 1/8	
	12	20	15	13 5/8	
20X	14	20	15	14	
	16	20	15	14	
	10	- 20	16 1/2	14 1/2	
	12	-	16 1/2	14 5/8	
	14	20	16 1/2	15	
22X	16	20	16 1/2	15	
	18	20	16 1/2	15 1/2	
	20	20	16 1/2	16	
	10	-	17	15 1/8	
	12	-	17	15 5/8	
	14	- 20	17	16	
24X	18	20	17	16 1/2	
	20	20	17	17	
	12	-	19 1/2	16 5/8	
	14	-	19 1/2	17	
	16	-	19 1/2	17	
26X	18	24	19 1/2	17 1/2	
	20	24	19 1/2	18	
	22	24	19 1/2	18 1/2	
	14	-	22	19	
	16	-	22	19	
	18	-	22	19 1/2	
	20	24	22	20	
30X	22	-	22	20 1/2	
	24	24	22	21	
	20	24	22	21 1/2	
	16	-	25	21 //2	
	18	-	25		
			20	21 1/2	
	20	-	25	21 1/2 22	
241	20 22	-	25 25 25	21 1/2 22 22 1/2	
347	20 22 24	- - 24	25 25 25 25	21 1/2 22 22 1/2 23	
347	20 22 24 26	- 24 24	25 25 25 25 25 25	21 1/2 22 22 1/2 23 23 1/2	
344	20 22 24 26 28	- 24 24 -	25 25 25 25 25 25 25	21 1/2 22 22 1/2 23 23 1/2 23 1/2 23 1/2	
34A	20 22 24 26 28 30 32	- 24 24 - 24 24 24	25 25 25 25 25 25 25 25 25	21 1/2 22 22 1/2 23 1/2 23 1/2 23 1/2 24 1/2	
34A	20 22 24 26 28 30 32 16	- 24 24 - 24 24 24	25 25 25 25 25 25 25 25 25 25 26 1/2	21 1/2 22 22 1/2 23 23 1/2 23 1/2 24 24 24 1/2 22	
34A	20 22 24 26 28 30 32 16 18	- 24 24 - 24 24 -	25 25 25 25 25 25 25 25 25 26 1/2 26 1/2	21 1/2 22 22 1/2 23 1/2 23 1/2 24 24 24 1/2 22 22 1/2	
	20 22 24 26 28 30 32 16 18 20	- 24 24 - 24 24 - -	25 25 25 25 25 25 25 25 25 26 1/2 26 1/2 26 1/2	21 1/2 22 22 1/2 23 1/2 23 1/2 23 1/2 24 24 1/2 22 22 1/2 23	
	20 22 24 26 28 30 32 16 18 20 22	- 24 24 - 24 - - - -	25 25 25 25 25 25 25 25 25 25 26 1/2 26 1/2 26 1/2 26 1/2 26 1/2	21 1/2 22 22 1/2 23 23 1/2 24 24 1/2 22 22 1/2 23 1/2 23 1/2 22 22 1/2 23 1/2	
	20 22 24 26 28 30 32 16 18 20 22 22 24 24	- 24 24 - - - - - - - 24 - - - - - - - -	25 25 25 25 25 25 25 25 25 26 1/2 26 1/2 26 1/2 26 1/2 26 1/2 26 1/2 26 1/2	21 1/2 22 22 1/2 23 1/2 24 24 24 24 24 22 1/2 22 22 1/2 23 23 1/2 24 24 24 1/2 22 24 24 24 24 24 24 24 24 24 24 24 24	
34X	20 22 24 26 30 32 16 18 20 22 24 24 26 20	- 24 24 - 24 - - - - - - - 24 24	25 25 25 25 25 25 25 25 25 26 1/2 26 1/2 26 1/2 26 1/2 26 1/2 26 1/2 26 1/2 26 1/2	21 1/2 22 22 1/2 23 1/2 23 1/2 24 24 1/2 22 22 1/2 23 1/2 23 1/2 24 24 1/2 24 24 1/2 24 24 1/2	
34X	20 22 24 28 30 32 16 18 20 22 24 26 28 30	- 24 24 - 24 - - - - 24 24 - - - - - - -	25 25 25 25 25 25 26 26 1/2 26 1/2 26 1/2 26 1/2 26 1/2 26 1/2 26 1/2 26 1/2 26 1/2 26 1/2 26 1/2 26 1/2 26 26 25 25 25 25 25 25 25 25 25 25 25 25 25	21 1/2 22 22 1/2 23 23 1/2 24 24 1/2 22 22 1/2 23 23 1/2 24 24 1/2 24 24 1/2 24 1/2 24 1/2 24 1/2 24 1/2 25	
34X 36X	20 22 24 26 30 32 16 18 20 22 24 24 26 28 30 32	- 24 24 - - - - - 24 24 - - 24 - 24 - 2	25 25 25 25 25 25 25 25 26 1/2 26 1/2 26 1/2 26 1/2 26 1/2 26 1/2 26 1/2 26 1/2 26 1/2 26 1/2 26 1/2 26 1/2 26 1/2 26 26 25 25 25 25 25 25 25 25 25 25 25 25 25	21 1/2 22 22 1/2 23 1/2 24 1/2 24 1/2 22 1/2 22 2 22 1/2 23 1/2 24 1/2 24 1/2 24 1/2 24 1/2 25 1/2	
34X	20 22 24 26 28 30 32 16 18 20 22 24 26 28 30 32 34	- 24 24 24 24 - - - - 24 24 24 24 24	25 25 25 25 25 25 25 26 1/2 26 1/2 26 1/2 26 1/2 26 1/2 26 1/2 26 1/2 26 1/2 26 1/2 26 1/2 26 1/2 26 1/2 26 1/2 26 1/2 26 1/2 26 1/2 26 25 25 25 25 25 25 25 25 25 25 25 25 25	21 1/2 22 22 1/2 23 1/2 23 1/2 24 24 1/2 22 1/2 23 23 1/2 24 24 1/2 24 24 1/2 24 24 1/2 24 24 1/2 25 1/2 26	
36X	20 22 24 26 28 30 32 16 18 20 22 24 26 28 30 32 32 32 34 24	- 24 24 - 24 - - - - 24 24 24 - 24 24 24 24 24	25 25 25 25 25 25 26 1/2 26 1/2 26 1/2 26 1/2 26 1/2 26 1/2 26 1/2 26 1/2 26 1/2 26 1/2 26 1/2 26 1/2 26 1/2 26 26 25 25 25 25 25 25 25 25 25 25 25 25 25	21 1/2 22 22 1/2 23 23 1/2 24 24 1/2 22 22 1/2 23 23 1/2 24 24 1/2 24 24 1/2 24 1/2 24 1/2 25 25 25 1/2 26	
36X	20 22 24 26 28 30 32 16 18 20 22 24 26 28 30 32 24 26 28 30 32 24 26	- 24 24 24 24 - - - 24 - 24 24 24 24 24 24 24	25 25 25 25 25 25 25 25 26 1/2 26 1/2 26 1/2 26 1/2 26 1/2 26 1/2 26 1/2 26 1/2 26 1/2 26 1/2 26 1/2 26 1/2 26 1/2 26 1/2 26 1/2 26 25 25 25 25 25 25 25 25 25 25 25 25 25	21 1/2 22 22 1/2 23 23 1/2 24 24 24 22 22 22 22 22 22 2	
36X 42X	20 22 24 26 28 30 32 16 18 20 22 24 26 28 30 32 34 24 24 24 26 30 30	- - - - - - - - - - - - - - - - - - -	25 25 25 25 25 25 25 25 26 1/2 26 26 25 25 25 25 25 25 25 25 25 25 25 25 25	21 1/2 22 22 1/2 23 1/2 23 1/2 24 24 1/2 22 1/2 23 23 1/2 24 24 1/2 24 24 1/2 24 24 1/2 25 25 1/2 26 - -	
36X 36X 42X	20 22 24 26 28 30 32 16 18 20 22 24 26 28 30 32 24 26 30 32 24 26 30 32 32 32 32 32 34	- 24 24 24 - 24 24 24 24 24 24 24 24 24 24 24 24 24	25 25 25 25 25 25 25 26 1/2 26 1/2 26 1/2 26 1/2 26 1/2 26 1/2 26 1/2 26 1/2 26 1/2 26 1/2 26 1/2 26 1/2 26 1/2 26 1/2 26 1/2 26 26 25 25 25 25 25 25 25 25 25 25 25 25 25	21 1/2 22 22 1/2 23 1/2 23 1/2 24 24 1/2 22 1/2 23 23 1/2 24 24 1/2 24 24 1/2 24 1/2 24 1/2 25 25 25 25 26 - -	



# WELDING NECK FLANGES

	150	LB.	30	0 LB.	400	LB.	600 LB.	
NOM PIPE Size	OUTSIDE Diam. of Flange O	LENGTH THRU HUB Y(1)	outside Diam. of Flange O	LENGTH THRU HUB Y(1)	OUTSIDE DIAM. OF Flange O	LENGTH THRU HUB Y(2)	outside Diam. of Flange O	Length Thru Hub Y(2)
1/2 3/4 1	3 1/2 3 7/8 4 1/4	1 7/8 2 1/16 2 3/16	3 3/4 4 5/8 4 7/8	2 1/16 2 1/4 2 7/16	For sizes 3 1/2 and smaller use 600 lb. Standard		3 3/4 4 5/8 4 7/8	2 1/16 2 1/4 2 7/16
1 1/4 1 1/2 2 2 1/2 3	4 5/8 5 6 7 7 1/2	2 1/4 2 7/16 2 1/2 2 3/4 2 3/4	5 1/4 6 1/8 6 1/2 7 1/2 8 1/4	2 9/16 2 11/16 2 3/4 3 3 1/8			5 1/4 6 1/8 6 1/2 7 1/2 8 1/4	2 5/8 2 3/4 2 7/8 3 1/8 3 1/4
3 1/2 4 5 6 8	8 1/2 9 10 11 13 1/2	2 13/16 3 3 1/2 3 1/2 4	9 10 11 12 1/2 15	3 3/16 3 1/8 3 7/8 3 7/8 4 3/8	10 11 12 1/2 15	3 1/2 4 4 1/16 4 5/8	9 10 3/4 13 14 16 1/2	3 3/8 4 4 1/2 4 5/8 5 1/4
10 12 14 16 18	16 19 21 23 1/2 25	4 4 1/2 5 5 5 5 1/2	17 1/2 20 1/2 23 25 1/2 28	4 5/8 5 1/8 5 5/8 5 3/4 6 1/4	17 1/2 20 1/2 23 25 1/2 28	4 7/8 5 3/85 5 7/8 6 6 1/2	20 22 23 3/4 27 29 1/4	6 6 1/8 6 1/2 7 7 1/4
20 22 24 26 30	27 1/2 29 1/2 32 34 1/4 38 3/4	5 11/16 5 7/8 6 5 5 1/8	30 1/2 33 36 38 1/4 43	6 3/8 6 1/2 6 5/8 7 1/4 8 1/4	30 1/2 33 36 38 1/4 43	6 5/8 6 3/4 6 7/8 7 5/8 8 5/8	32 34 1/4 37 40 44 1/2	7 1/2 7 3/4 8 3/4 9 3/4
34 36 42	43 3/4 46 53	5 5/16 5 3/8 5 5/8	47 1/2 50 57	9 1/8 9 1/2 10 7/8	47 1/2 50 57	9 1/2 9 7/8 11 3/8	49 51 3/4 58 3/4	10 5/8 11 1/5 12 3/4

All dimensions given in inches.

(1) The 1/4" raised face is not included in minimum thickness "T" and lengths Y1 and Y2.

All dimensions given in inches. (1) The 1/16" raised face is included in minimum thickness "T" and lengths Y1 and Y2.





SLIP-ON, THREADED & SOCKET TYPE FLANGES

	150	LB.	30	0 LB.	400	LB.	600 LB.	
NOM PIPE Size	OUTSIDE Diam. Of Flange O	LENGTH THRU HUB Y(1)	OUTSIDE Diam. Of Flange O	Length Thru Hub Y(1)	OUTSIDE DIAM. OF Flange O	LENGTH THRU HUB Y(2)	OUTSIDE DIAM. OF Flange O	length Thru Hub Y(2)
1/4 3/8 1/2 3/4 1	3 1/2 3 1/2 3 1/2 3 7/8 4 1/4	5/8°↑ 5/8 5/8 5/8 11/16	3 3/4 3 3/4 3 3/4 4 5/8 4 7/8	7/8°↑ 7/8°↑ 7/8 1 1 1/16	For sizes 3 1/2 and smaller use 600 lb. Standard		3 3/4 3 3/4 3 3/4 4 7/8 4 7/8	7/8°↑ 7/8°↑ 7/8 1 1 1/16
1 1/4 1 1/2 2 2 1/2 3	4 5/8 5 6 7 7 1/2	13/16 7/8 1 1 1/8 1 3/16	5 1/4 6 1/8 6 1/2 7 1/2 8 1/4	1 1/16 1 3/16 1 5/16 1 1/2 1 11/16			5 1/4 6 1/8 6 1/2 7 1/2 8 1/4	1 1/8 1 1/4 1 7/16 1 5/8 1 13/16
3 1/2 4 5 6 8	8 1/2 9 10 11 13 1/2	1 1/4 1 5/16 1 7/16 1 9/16 1 3/4	9 10 11 12 1/2 15	1 3/4 1 7/8 2 ¢ 2 1/16 ¢ 2 7/16 ¢	10 11 12 1/2 15	2 ‡ 2 1/8 ‡ 2 1/4 ‡ 2 11/16 ‡	9 10 3/4 13 14 16 1/2	1 15/16 2 1/8 ‡ 2 3/8 ‡ 2 5/8 ‡ 3 ‡
10 12 14 16 18	16 19 21 23 1/2 25	1 15/16 2 3/16 2 1/4 2 1/2 2 11/16	17 1/2 20 1/2 23 25 1/2 28	2 5/8 ‡ 2 7/8 ‡ 3 ‡ 3 1/4 ‡ 3 1/2 ‡	17 1/2 20 1/2 23 25 1/2 28	2 7/8 ‡ 3 1/8 ‡ 3 5/16 ‡ 3 11/16 ‡ 3 7/8 ‡	20 22 23 3/4 27 29 1/4	3 3/8 ‡ 3 5/8 ‡ 3 11/16 ‡ 4 3/16 ‡ 4 5/8 ‡
20 22 24 26 30	27 1/2 29 1/2 32 34 1/4 38 3/4	2 7/8 3 1/8†‡ 3 1/4 3 3/8†‡ 3 1/2†‡	30 1/2 33 36 38 1/4 43	3 3/4 ↓ 4 ↑↓ 4 3/16 ↓ 7 1/4 ↑↓ 8 1/4 ↑↓	30 1/2 33 36 38 1/4 43	4 ↓ 4 1/4 ↑↓ 4 1/2 ↓ 7 5/8 ↑↓ 8 5/8 ↑↑	32 34 1/4 37 40 44 1/2	5 ‡ 5 1/4 †‡ 5 1/2 ‡ 8 3/4 †‡ 9 3/4 ††
34 36 42	43 3/4 46 53	3 11/16†‡ 3 3/4 †‡ 4 †‡	47 1/2 50 57	9 1/8†‡ 9 1/2†‡ 10 7/8†‡	47 1/2 50 57	9 1/2 ↑‡ 9 7/8 11‡ 11 3/8 ↑↑	49 51 3/4 58 3/4	10 5/8 †‡ 11 1/8 †‡ 12 3/4 ††

All dimensions given in inches.

(1) The 1/4" raised face is not included in minimum thickness "T" and lengths Y1 and Y2.

All dimensions given in inches.

(1) The 1/16" raised face is included in minimum thickness "T" and lengths Y1 and Y2.



# LAP JOINT FLANGES

	150	LB.	30	0 LB.	400	LB.	600 LB.	
NOM PIPE Size	OUTSIDE Diam. Of Flange O	LENGTH THRU HUB Z(1)	OUTSIDE DIAM. OF Flange O	LENGTH Thru Hub Z(1)	OUTSIDE DIAM. OF Flange O	LENGTH Thru Hub Z(2)	OUTSIDE DIAM. OF Flange O	length Thru Hub Z(2)
1/2 3/4 1	3 1/2 3 7/8 4 1/4	5/8 5/8 11/16	3 3/4 4 5/8 4 7/8	7/8 1 1 1/16	For sizes 3 1/2 and smaller use 600 lb. Standard		3 3/4 4 5/8 4 7/8	7/8 1 1 1/16
1 1/4 1 1/2 2 2 1/2 3	4 5/8 5 6 7 7 1/2	13/16 7/8 1 1 1/8 1 3/16	5 1/4 6 1/8 6 1/2 7 1/2 8 1/4	1 1/16 1 3/16 1 5/16 1 1/2 1 11/16			5 1/4 6 1/8 6 1/2 7 1/2 8 1/4	1 1/8 1 1/4 1 7/16 1 5/8 1 13/16
3 1/2 4 5 6 8	8 1/2 9 10 11 13 1/2	1 1/4 1 5/16 1 7/16 1 9/16 1 3/4	9 10 11 12 1/2 15	1 3/4 1 7/8 2 2 1/16 2 7/16	10 11 12 1/2 15	2 2 1/8 2 1/4 2 11/16	9 10 3/4 13 14 16 1/2	1 15/16 2 1/8 2 3/8 2 5/8 3
10 12 14 16 18	16 19 21 23 1/2 25	1 15/16 2 3/16 3 1/8 3 7/16 3 13/16	17 1/2 20 1/2 23 25 1/2 28	3 3/4 4 4 3/8 4 3/4 5 1/8	17 1/2 20 1/2 23 25 1/2 28	4 4 1/4 4 5/8 5 5 3/8	20 22 23 3/4 27 29 1/4	4 3/8 4 5/8 5 5 1/2 6
20 24	27 1/2 32	4 1/16 4 3/8	30 1/2 36	5 1/2 6	30 1/2 36	5 3/4 6 1/4	32 37	6 1/2 7 1/4



## **BLIND FLANGES**

	150	LB.	30	0 LB.	400	LB.	600 LB.	
NOM PIPE Size	outside Diam. of Flange O	THICK- NESS Q (1)	OUTSIDE DIAM. OF Flange O	THICK- NESS Q (1)	OUTSIDE DIAM. OF FLANGE O	THICK- NESS Q (2)	OUTSIDE DIAM. OF FLANGE O	Thick- Ness Q (2)
1/2	3 1/2	7/16	3 3/4	9/16	For sizes 2.1/0 and		3 3/4	9/16
3/4	3 7/8	1/2	4 5/8	5/8			4 5/8	5/8
1	4 1/4	9/16	4 7/8	11/16			4 7/8	11/16
1 1/4	4 5/8	5/8	5 1/4	3/4			5 1/4	13/16
1 1/2	5	11/16	6 1/8	13/16			6 1/8	7/8
2 2 1/2 3 3 1/2 4	6 7 7 1/2 8 1/2 9	3/4 7/8 15/16 15/16 15/16	6 1/2 7 1/2 8 1/4 9 10	7/8 1 1 1/8 1 3/16 1 1/4	smaller us Sta	1 3/8	6 1/2 7 1/2 8 1/4 9 10 3/4	1 1 1/8 1 1/4 1 3/8 1 1/2
5	10	15/16	11	1 3/8	11	1 1/2	13	1 3/4
6	11	1	12 1/2	1 7/16	12 1/2	1 5/8	14	1 7/8
8	13 1/2	1 1/8	15	1 5/8	15	1 7/8	16 1/2	2 3/16
10	16	1 3/16	17 1/2	1 7/8	17 1/2	2 1/8	20	2 1/2
12	19	1 1/4	20 1/2	2	20 1/2	2 1/4	22	2 5/8
14	21	1 3/8	23	2 1/8	23	2 3/8	23 3/4	2 3/4
16	23 1/2	1 7/16	25 1/2	2 1/4	25 1/2	2 1/2	27	3
18	25	1 9/16	28	2 3/8	28	2 5/8	29 1/4	3 1/4
20	27 1/2	1 11/16	30 1/2	2 1/2	30 1/2	2 3/4	32	3 1/2
22	29 1/2	1 13/16	33	2 5/8	33	2 7/8	34 1/4	3 3/4
24	32	1 7/8	36	2 3/4	36	3	37	4
26	34 1/4	2	38 1/4	3 1/8	38 1/4	3 1/2	40	4 1/4
30	38 3/4	2 1/8	43	3 5/8	43	4	44 1/4	4 1/2
34	43 3/4	2 5/16	47 1/2	4	47 1/2	4 3/8	49	4 3/4
36	46	2 3/8	50	4 1/8	50	4 1/2	51 3/4	4 7/8
42	53	2 5/8	57	4 5/8	57	5 1/8	58 3/4	5 1/2

# **BOLTING DIMENSIONS FOR 150LB. FLANGES**

	150 LB. STEEL FLANGES								
NOMINAL PIPE SIZE	DIAM OF BOLT CIRCLE	DIAMETER OF BOLTS	NUMBER OF BOLTS	LENGTH OF STUDS 1/16" RAISED FACE	BOLT LENGTH FOR 125 LB. CAST IRON FLANGES				
1/2	2 3/8	1/2	4	2 1/4					
3/4	2 3/4	1/2	4	2 1/4					
1	3 1/8	1/2	4	2 1/2	1 3/4				
1 1/4	3 1/2	1/2	4	2 1/2	2				
1 1/2	3 7/8	1/2	4	2 3/4	2				
2	4 3/4	5/8	4	3	2 1/4				
2 1/2	5 1/2	5/8	4	3 1/4	2 1/2				
3	6	5/8	4	3 1/2	2 1/2				
3 1/2	7	5/8	8	3 1/2	2 3/4				
4	7 1/2	5/8	8	3 1/2	3				
5	8 1/2	3/4	8	3 3/4	3				
6	9 1/2	3/4	8	3 3/4	3 1/4				
8	11 3/4	3/4	8	4	3 1/2				
10	14 1/4	7/8	12	4 1/2	3 3/4				
12	17	7/8	12	4 1/2	3 3/4				
14	18 3/4	1	12	5	4 1/4				
16	21 1/4	1	16	5 1/4	4 1/2				
18	22 3/4	1 1/8	16	5 3/4	4 3/4				
20	25	1 1/8	20	6	5				
22	27 1/4	1 1/4	20	6 1/2					
24	29 1/2	1 1/4	20	6 3/4	5 1/2				
26	31 3/4	1 1/4	24	7					
30	36	1 1/4	28	7 1/4	6 1/4				
34	40 1/2	1 1/2	32	8					
36	42 3/4	1 1/2	32	8 1/4	7				
42	49 1/2	1 1/2	36	8 3/4	7 1/2				

# **BOLTING DIMENSIONS FOR 300LB. FLANGE**

	300 LB. STEEL FLANGES								
NOMINAL PIPE SIZE	DIAM OF BOLT CIRCLE	DIAMETER OF BOLTS	NUMBER OF BOLTS	LENGTH OF STUDS 1/16" RAISED FACE	BOLT LENGTH FOR 125 LB. CAST IRON FLANGES				
1/2	2 5/8	1/2	4	2 1/2	2 .00				
3/4	3 1/4	5/8	4	2 3/4	2 1/2				
1	3 1/2	5/8	4	3	2 1/2				
1 1/4	3 7/8	5/8	4	3	2 3/4				
1 1/2	4 1/2	3/4	4	3 1/2	3				
2	5	5/8	8	3 1/4	3				
2 1/2	5 7/8	3/4	8	3 3/4	3 1/2				
3	6 5/8	3/4	8	4	3 1/2				
3 1/2	7 1/4	3/4	8	4 1/4	3 3/4				
4	7 7/8	3/4	8	4 1/4	3 3/4				
5	9 1/4	3/4	8	4 1/2	4				
6	10 5/8	3/4	12	4 3/4	4 1/4				
8	13	7/8	12	5 1/4	4 3/4				
10	15 1/4	1	16	6	5 1/4				
12	17 3/4	1 1/8	16	6 1/2	5 3/4				
14	20 1/4	1 1/8	20	6 3/4	6				
16	22 1/2	1 1/4	20	7 1/4	6 1/2				
18	24 3/4	1 1/4	24	7 1/2	6 3/4				
20	27	1 1/4	24	8	7 1/2				
22	29 1/4	1 1/2	24	8 3/4	7				
24	32	1 1/2	24	9	7 3/4				
26	34 1/2	1 5/8	28	10	8 3/4				
30	39 1/4	1 3/4	28	11 1/4	10				
34	43 1/2	1 7/8	28	12 1/4	10 3/4				
36	46	2	32	12 3/4	11 1/4				
42	52 3/4	2	36	13 3/4	13 1/2				

## BOLTING DIMENSIONS FOR 400 LB. AND 600 LB. FLANGE

		400 LB. STEE	L FLANGES	5	600 LB. STEEL FLANGES			
NOMINAL Pipe size	DIAM OF Bolt circle	DIAMETER OF Bolts	NUMBER OF BOLTS	LENGTH OF STUDS 1/16" RAISED FACE	DIAMETER OF Bolt Circle	DIAMETER OF BOLTS	NUMBER OF BOLTS	LENGTH OF STUDS 1/16" RAISED FACE
1/2	2 5/8	1/2	4	3	2 5/8	1/2	4	3
3/4	3 1/4	5/8	4	3 1/2	3 1/4	5/8	4	3 1/4
1	3 1/2	5/8	4	3 1/2	3 1/2	5/8	4	3 1/2
1 1/4	3 7/8	5/8	4	3 3/4	3 7/8	5/8	4	3 3/4
1 1/2	4 1/2	3/4	4	4 1/4	4 1/2	3/4	4	4 1/4
2	5	5/8	8	4 1/4	5	5/8	8	4 1/4
2 1/2	5 7/8	3/4	8	4 3/4	5 7/8	3/4	8	5
3	6 5/8	3/4	8	5	6 5/8	3/4	8	5
3 1/2	7 1/4	7/8	8	5 1/2	7 1/4	7/8	8	5 1/2
4	7 7/8	7/8	8	5 1/2	8 1/2	7/8	8	5 3/4
5	9 1/4	7/8	8	5 3/4	10 1/2	1	8	6 1/2
6	10 5/8	7/8	12	6	11 1/2	1	12	6 3/4
8	13	1	12	6 3/4	13 3/4	1 1/8	12	7 3/4
10	15 1/4	1 1/8	16	7 1/2	17	1 1/4	16	8 1/2
12	17 3/4	1 1/4	16	8	19 1/4	1 1/4	20	8 3/4
14	20 1/4	1 1/4	20	8 1/4	20 3/4	1 3/8	20	9 1/4
16	22 1/2	1 3/8	20	8 3/4	23 3/4	1 1/2	20	10
18	24 3/4	1 3/8	24	9	25 3/4	1 5/8	20	10 3/4
20	27	1 1/2	24	9 1/2	28 1/2	1 5/8	24	11 1 /2
22	29 1/4	1 5/8	24	10	30 5/8	1 3/4	24	12
24	32	1 3/4	24	10 1/2	33	1 7/8	24	13
26	34 1/2	1 3/4	28	11 1/2	36	1 7/8	28	13 1/4
30	39 1/4	2	28	13	40 1/4	2	28	14
34	43 1/2	2	28	13 3/4	40 1/2	2 1/4	28	15
36	46	2	32	14	47	2 1/2	28	15 3/4
42	50 3/4	2 1/2	32	16 1/4	53 3/4	2 3/4	28	17 1/2

# HOW TO CUT ODD-ANGLE ELBOWS





# ODD DEGREE LONG RADIUS ELBOWS

	OUTSIDE ARC													
NOMINAL PIPE SIZE	Α	В	С	D	E	F	G							
2	5/64	3/8	23/32	1 3/32	1 21/32	2 3/4	3 9/32							
2 1/2	3/32	7/16	29/32	1 11/32	2 1/32	3 3/8	4 1/6							
3	7/64	9/16	1 1/8	1 5/8	2 15/32	4 3/32	4 29/32							
3 1/2	1/8	5/8	1 9/32	1 29/32	2 27/32	4 3/4	5 11/16							
4	9/64	23/32	1 7/16	2 5/32	3 1/4	5 13/32	6 15/32							
5	3/16	29/32	1 25/32	2 11/16	4 1/32	6 23/32	8 1/16							
6	7/32	1 1/16	2 5/32	3 7/32	4 27/32	8 1/16	9 21/32							
8	9/32	1 7/16	2 27/32	4 9/32	6 13/32	10 11/16	12 13/16							
10	11/32	1 25/32	3 9/16	5 11/32	8	13 11/32	16							
12	7/16	2 1/8	4 1/4	6 3/8	9 9/16	15 31/32	19 5/32							
14	1/2	2 7/16	4 7/8	7 5/16	11	18 5/16	22							
16	9/16	2 13/16	5 19/32	8 3/8	12 9/16	20 15/16	25 1/8							
18	5/8	3 1/8	6 9/32	9 7/16	14 1/8	23 9/16	28 9/32							
20	11/16	3 1/2	7	10 15/32	15 23/32	26 3/16	31 13/32							
22	3/4	3 27/32	7 11/16	11 17/32	17 9/32	28 13/16	34 9/16							
24	27/32	4 3/16	8 3/8	12 9/16	18 27/32	31 13/32	37 11/16							
26	29/32	4 17/32	9 3/32	13 5/8	20 13/32	34 1/32	40 27/32							
30	1 1/32	5 1/4	10 15/32	15 3/4	23 9/16	39 1/4	47 1/8							
34	1 5/32	5 29/32	11 27/32	17 13/16	26 23/32	44 17/32	53 3/8							
36	1 7/32	6 1/4	12 17/32	18 7/8	28 7/32	47	56 17/32							
42	1 7/16	7 5/16	14 5/8	22	32 31/32	54 31/32	65 15/16							



# ODD DEGREE LONG RADIUS ELBOWS

INSIDE ARC												
NOMINAL PIPE SIZE	AA	BB	CC	DD	EE	FF	GG					
2	1/32	5/32	5/16	15/32	23/32	1 3/16	1 7/16					
2 1/2	3/64	3/16	13/32	19/32	29/32	1 1/2	1 13/16					
3	3/64	1/4	1/2	23/32	1 3/32	1 13/16	2 5/32					
3 1/2	1/16	9/32	9/16	27/32	1 9/32	2 1/8	2 9/16					
4	1/16	5/16	21/32	31/32	1 15/32	2 7/16	2 15/16					
5	5/64	13/32	13/16	1 1/4	1 27/32	3 3/32	3 23/32					
6	3/32	1/2	1	1 1/2	2 7/32	3 23/32	4 15/32					
8	1/8	11/16	1 1 1/32	2	3 1/32	5 1/32	6 1/32					
10	5/32	27/32	1 11/16	2 17/32	3 25/32	6 5/16	7 9/16					
12	7/32	1	2 1/32	3 1/6	4 9/16	7 19/32	9 1/8					
14	1/4	1 7/32	2 7/16	3 21/32	5 1/2	9 5/32	11					
16	9/32	1 13/32	2 13/16	4 3/16	6 9/32	10 15/32	12 5/8					
18	5/16	1 9/16	3 1/8	4 23/32	7 1/16	11 25/32	14 1/8					
20	11/32	1 3/4	3 1/2	5 1/4	7 27/32	13 3/32	15 11/16					
22	3/8	1 29/32	3 27/32	5 3/4	8 5/8	14 3/8	17 9/32					
24	13/32	2 3/32	4 3/16	6 9/32	9 7/16	15 11/16	18 27/32					
26	15/32	2 9/32	4 17/32	6 13/16	10 7/32	17 1/32	20 13/32					
30	17/32	2 5/8	5 1/4	7 7/8	11 25/32	19 5/8	23 9/16					
34	19/32	2 31/32	5 29/32	8 29/32	13 3/8	22 9/32	26 11/16					
36	5/8	2 13/16	6 1/4	9 7/16	14 1/8	25 5/8	28 1/4					
42	23/32	3 21/32	7 5/16	10 19/32	16 1/2	26 3/8	32 31/32					

# TAKE OFF FOR ELLS 1° to 90°

To find the take off multiply the tangent of 1/2 the degree of ELL by the radius. Following table is for long radius ELL. Which radius equals 1 1/2 times size. Take off for ELLs  $1^{\circ}$  to  $90^{\circ}$ .

Take off is from center to face of ELL each way on any degree.



Size	<b>1</b> °	<b>2</b> °	3°	<b>4</b> °	5°	6°	<b>7</b> °	8°	9°
2"	1/32	1/16	1/16	1/8	1/8	5/32	3/16	3/16	1/4
3"	1/16	3/32	1/8	5/32	7/32	1/4	5/16	5/16	3/8
4"	1/16	1/8	5/32	7/32	9/32	5/16	3/8	3/8	1/2
6"	3/32	3/16	1/4	5/16	7/16	1/2	9/16	5/8	11/16
8"	1/8	1/4	5/16	7/16	9/16	5/8	3/4	13/16	15/16
10"	5/32	5/16	3/8	9/16	11/16	3/4	15/16	1	1 3/16
12"	3/16	3/8	15/32	5/8	7/8	15/16	1 1/8	1 1/4	1 7/16
14"	7/32	7/16	9/16	3/4	1	1 1/8	1 5/16	1 7/16	1 5/8
16"	1/4	1/2	5/8	7/8	1 1/8	1 1/4	1 1/2	1 5/8	1 7/8
18"	9/32	9/16	11/16	1	1 1/4	1 3/8	1 11/16	1 13/16	2 1/8
20"	5/16	5/8	3/4	1 1/8	1 3/8	1 9/16	1 7/8	2	2 3/8
24"	3/8	3/4	15/16	1 5/16	1 11/16	1 7/8	2 1/4	2 7/16	2 13/16

# TAKE OFF FOR ELLS 1° to 90°

Size	10°	<b>11</b> °	12°	13°	<b>14</b> °	15°	16°	17°	18°
2"	1/4	5/16	5/16	3/8	3/8	3/8	7/16	7/16	1/2
3"	3/8	7/16	1/2	1/2	9/16	5/8	5/8	11/16	11/16
4"	1/2	5/8	5/8	11/16	3/4	3/4	7/8	7/8	15/16
6"	3/4	7/8	15/16	1	1 1/8	1 3/16	1 1/4	1 3/8	1 7/16
8"	1	1 3/16	1 1/4	1 3/8	1 1/2	1 9/16	1 11/16	1 13/16	1 7/8
10"	1 1/4	1 1/2	1 9/16	1 3/4	1 7/8	1 15/16	2 1/8	2 1/4	2 3/8
12"	1 1/2	1 3/4	1 7/8	2 1/16	2 1/4	2 3/8	2 9/16	2 3/4	2 13/16
14"	1 3/4	2 1/16	2 3/16	2 7/16	2 5/8	2 3/4	2 15/16	3 3/16	3 5/16
16"	2	2 3/8	2 1/2	2 3/4	3	3 1/8	3 3/8	3 5/8	3 3/4
18"	2 1/4	2 11/16	2 13/16	3 1/16	3 3/8	3 1/2	3 13/16	4 1/16	4 1/4
20"	2 1/2	3	3 1/8	3 7/16	3 3/4	3 7/8	4 1/4	4 1/2	4 11/16
24"	3	3 9/16	3 3/4	4 1/8	4 1/2	4 11/16	5 1/16	5 7/16	5 5/8

Size	19°	<b>20</b> °	<b>21</b> °	<b>22</b> °	<b>23</b> °	<b>24</b> °	<b>25</b> °	<b>26</b> °	<b>27</b> °
2"	1/2	9/16	9/16	9/16	5/8	5/8	11/16	11/16	3/4
3"	3/4	13/16	7/8	7/8	13/16	1	1	1 1/16	1 1/16
4"	1	1 1/16	1 1/8	1 1/4	1 5/16	1 5/16	1 3/8	1 3/8	1 7/16
6"	1 1/2	1 9/16	1 11/16	1 3/4	1 13/16	1 15/16	2	2 1/16	2 1/4
8"	2	2 1/8	2 1/4	2 5/16	2 7/16	2 9/16	2 11/16	2 3/4	2 7/8
10"	2 1/2	2 5/8	2 13/16	2 7/8	3 1/16	3 3/16	3 1/8	3 7/16	3 9/16
12"	3	3 3/16	3 3/8	3 1/2	3 5/8	3 13/16	4	4 1/8	4 5/16
14"	3 1/2	3 3/4	3 15/16	4 1/16	4 1/4	4 1/2	4 11/16	4 13/16	5 1/16
16"	4	4 1/4	4 1/2	4 5/8	4 7/8	5 1/8	5 3/8	5 1/2	5 3/4
18"	4 1/2	4 13/16	5 1/16	5 3/16	5 1/2	5 3/4	6 1/16	6 3/16	6 1/2
20"	5	5 5/16	5 5/8	5 7/8	6 1/8	6 3/8	6 3/4	6 7/8	7 3/16
24"	6	6 3/8	6 3/8	6 15/16	7 5/16	7 11/16	8 1/16	8 1/4	8 5/8

TAKE OFF FOR ELLS 1° to 90°

Size	<b>28</b> °	29°	30°	31°	32°	33°	<b>34</b> °	35°	36°
2"	3/4	3/4	13/16	13/16	7/8	7/8	15/16	15/16	1
3"	1 1/8	1 3/16	1 3/16	1 1/4	1 5/16	1 5/16	1 3/8	1 7/16	1 7/16
4"	1 1/2	1 9/16	1 5/8	1 11/16	1 3/4	1 13/16	1 7/8	1 15/16	1 15/16
6"	2 1/4	2 3/8	2 3/8	2 1/2	2 9/16	2 11/16	2 3/4	2 7/8	2 15/16
8"	3	3 1/8	3 3/16	3 5/16	3 7/16	3 9/16	3 11/16	3 13/16	3 7/8
10"	3 1/4	3 15/16	4	4 1/8	4 5/16	4 7/16	4 5/8	4 3/4	4 7/8
12"	4 1/2	4 11/16	4 13/16	5	5 3/16	5 3/8	5 9/16	5 3/4	5 13/16
14"	5 1/4	5 1/2	5 9/16	5 13/16	6	6 1/4	6 7/16	6 11/16	6 13/16
16"	6	6 1/4	6 3/8	6 5/8	6 7/8	7 1/8	7 3/8	7 5/8	7 3/4
18"	6 3/4	7	7 3/16	7 5/16	7 3/4	8	8 5/16	8 11/16	8 3/4
20"	7 1/2	7 13/16	8	8 5/16	8 5/8	8 15/16	9 1/4	9 9/16	9 11/16
24"	9	9 3/8	9 9/16	9 15/16	10 5/16	10 11/16	11 1/16	11 7/16	11 5/8

Size	37°	<b>38</b> °	<b>39</b> °	40°	<b>41</b> °	42°	43°	<b>44</b> °	45°
2"	1	1 1/16	1 1/16	1 1/8	1 1/8	1 3/16	1 3/16	1 1/4	1 1/4
3"	1 1/2	1 9/16	1 5/8	1 5/8	1 11/16	1 3/4	1 13/16	1 13/16	1 7/8
4"	2	2 1/16	2 1/8	2 3/16	2 1/4	2 5/16	2 3/8	2 7/16	2 1/2
6"	3	3 1/8	3 3/16	3 5/16	3 3/8	3 1/2	3 9/16	3 11/16	3 3/4
8"	4	4 1/8	4 1/4	4 3/8	4 1/2	4 5/8	4 3/4	4 7/8	5
10"	5	5 3/16	5 5/16	5 1/2	5 5/8	5 13/16	5 15/16	6 1/8	6 1/4
12"	6	6 3/16	6 3/8	6 9/16	6 3/4	6 15/16	7 1/8	7 5/16	7 1/2
14"	7	7 1/4	7 7/16	7 11/16	7 7/8	8 1/8	8 5/16	8 9/16	8 3/4
16"	8	8 1/4	8 1/2	8 3/4	9	9 1/4	9 1/2	9 3/4	10
18"	9	9 5/16	9 9/16	9 7/8	10 1/8	10 7/16	10 13/16	11	11 1/4
20"	10	10 5/16	10 5/8	10 15/16	11 1/4	11 9/16	11 7/8	12 3/16	12 1/2
24"	12	12 3/8	12 3/4	13 1/8	13 1/2	13 7/8	14 1/4	14 5/8	15
# TAKE OFF FOR ELLS 1° to 90°

Size	46°	47°	48°	49°	50°	51°	52°	53°	54°
2"	1 5/16	1 5/16	1 3/8	1 3/8	1 7/16	1 7/16	11/2	11/2	1 9/16
3"	1 15/16	2	2	2 1/16	2 1/8	2 3/16	2 3/16	2 1/4	2 5/16
4"	2 9/16	2 5/8	2 11/16	2 3/4	2 13/16	2 7/8	215/16	3	3 1/16
6"	3 7/8	3 15/16	4	4 1/8	4 1/4	4 5/16	4 7/16	4 1/2	4 5/8
8"	5 1/8	5 1/4	5 3/8	5 1/2	5 5/8	5 3/4	5 7/8	6	6 1/8
10"	6 7/16	6 9/16	6 3/4	6 7/8	7	7 3/16	7 3/8	7 1/2	7 11/16
12"	7 11/16	7 7/8	8 1/16	8 1/4	8 7/16	8 5/8	813/16	9	9 3/16
14"	9	9 3/16	9 7/16	9 5/8	9 7/8	10 1/16	10 5/16	10 1/2	10 3/4
16"	10 1/4	10 1/2	10 3/4	11	11 1/4	11 1/2	11 3/4	12	12 1/4
18"	11 9/16	11 13/16	12 1/8	12 3/8	12 11/16	12 15/16	13 1/4	13 1/2	13 13/16
20"	12 13/16	13 1/8	13 7/16	13 1/4	14 1/16	14 3/8	14 11/16	15	15 5/16
24"	15 3/8	15 3/4	16 1/8	19 7/8	16 7/8	17 1/4	17 5/8	18	18 3/8

Size	55°	56°	57°	58°	59°	60°	61°	62°	63°
2"	1 9/16	1 5/8	1 5/8	1 11/16	1 11/16	1 3/4	1 3/4	1 13/16	1 7/8
3"	2 3/8	2 3/8	2 7/16	2 1/2	2 9/16	2 5/8	2 11/16	2 11/16	2 3/4
4"	3 1/8	3 3/16	3 1/4	3 5/16	3 7/16	3 1/2	3 9/16	3 5/8	3 11/16
6"	4 11/16	4 13/16	4 7/8	5	5 1/8	5 3/16	5 5/16	5 3/8	5 9/16
8"	6 1/4	6 3/8	6 1/2	6 5/8	6 13/16	6 15/16	7 1/16	7 3/16	7 3/8
10"	7 13/16	8	8 1/8	8 5/16	8 1/2	8 11/16	8 13/16	9	9 1/4
12"	9 3/8	9 9/16	9 3/4	9 15/16	10 1/4	10 7/16	10 5/8	10 13/16	11 1/16
14"	10 15/16	11 3/16	11 3/8	11 5/8	11 15/16	12 1/8	12 3/8	12 9/16	12 15/16
16"	12 1/2	12 3/4	13	13 1/4	13 5/8	13 7/8	14 1/8	14 3/8	14 3/4
18"	14 1/16	14 3/8	14 5/8	14 15/16	15 5/16	15 5/8	15 7/8	16 3/16	16 5/8
20"	15 5/8	15 15/16	16 1/4	16 9/16	17 1/16	17 3/8	17 11/16	18	18 7/16
24"	18 3/4	19 1/8	19 1/2	19 7/8	20 7/16	20 13/16	21 3/16	21 9/16	22 1/8

# TAKE OFF FOR ELLS 1° to 90°

Size	64°	65°	66°	67°	68°	69°	70°	71°	72°
2"	1 7/8	1 15/16	1 15/16	2	2 1/16	2 1/16	2 1/8	2 1/8	2 3/16
3"	2 13/16	2 7/8	2 15/16	3	3 1/16	3 1/8	3 1/8	3 1/4	3 5/16
4"	3 3/4	3 15/16	3 15/16	4	4 1/16	4 1/8	4 1/4	4 5/16	4 3/8
6"	5 5/8	5 3/4	5 7/8	5 15/16	6 1/8	6 3/16	6 5/16	6 7/16	6 9/16
8"	7 1/2	7 5/8	7 13/16	7 15/16	8 1/8	8 1/4	8 7/16	8 9/16	8 3/4
10"	9 3/8	9 9/16	9 3/4	9 15/16	10 1/8	10 5/8	10 9/16	10 11/16	10 15/16
12"	11 1/4	11 7/16	11 3/4	11 15/16	12 3/16	12 3/8	12 11/16	12 7/8	13 1/8
14"	13 1/8	13 3/8	13 11/16	13 7/8	14 1/4	14 7/16	14 3/4	15	15 5/16
16"	15	15 1/4	15 5/8	15 7/8	16 1/4	16 1/2	16 7/8	17 1/8	17 1/2
18"	16 7/8	17 3/16	17 9/16	17 7/8	18 5/16	18 9/16	19	19 1/4	19 11/16
20"	18 3/4	19 1/16	19 9/16	19 7/8	20 5/16	20 5/8	21 1/8	21 7/16	21 7/8
24"	22 1/2	22 7/8	23 7/16	23 13/16	24 3/8	24 3/4	25 5/16	25 11/16	26 1/4

Size	73°	74°	75°	76°	77°	78°	79°	80°	81°
2"	2 1/4	2 1/4	2 5/16	2 3/8	2 3/8	2 7/16	2 1/2	2 1/2	2 9/16
3"	3 5/16	3 7/16	3 1/2	3 1/2	3 5/8	3 5/8	3 11/16	3 3/4	3 7/8
4"	4 7/16	4 1/2	4 5/8	4 11/16	4 3/4	4 7/8	4 15/16	5	5 1/8
6"	6 11/16	6 13/16	6 15/16	7	7 3/16	7 5/16	7 3/8	7 1/2	7 11/16
8"	8 7/8	9 1/16	9 1/4	9 3/8	9 9/16	9 3/4	9 7/8	10	10 1/4
10"	11 1/8	11 5/16	11 9/16	11 3/4	11 15/16	12 3/16	12 3/8	12 1/2	12 13/16
12"	13 5/16	13 5/8	13 7/8	14 1/16	14 3/8	14 5/8	14 13/16	15	15 3/8
14"	15 9/16	15 7/8	16 3/16	16 3/8	16 3/4	17 1/16	17 1/4	17 1/2	17 15/16
16"	17 3/4	18 1/8	18 1/2	18 3/4	19 1/8	19 1/2	19 3/4	20	20 1/2
18"	20	20 3/8	20 13/16	21 1/8	21 1/2	21 15/16	22 1/4	22 1/2	23 1/16
20"	22 3/16	22 5/8	23 1/8	23 7/16	23 7/8	24 3/8	24 11/16	25	25 5/8
24"	26 5/8	27 3/16	27 3/4	28 1/8	28 11/16	29 1/4	29 5/8	30	30 3/4

## TAKE OFF FOR ELLS 1° to 90°

Size	<b>82</b> °	83°	<b>8</b> 4°	85°	86°	87°	<b>88</b> °	<b>89</b> °	90°
2"	2 5/8	2 5/8	2 11/16	2 3/4	2 13/16	2 7/8	2 15/16	2 15/16	3
3"	3 7/8	4	4 1/16	4 1/8	4 3/16	4 1/4	4 3/8	4 7/16	4 1/2
4"	5 1/4	5 5/16	5 3/8	5 1/2	5 9/16	5 11/16	5 13/16	5 7/8	6
6"	7 13/16	8	8 1/8	8 1/4	8 3/8	8 1/2	8 3/4	8 7/8	9
8"	107/16	10 5/8	10 13/16	11	11 3/16	11 3/8	11 5/8	11 13/16	12
10"	13 1/16	13 3/8	13 1/2	13 3/4	14	14 1/4	14 1/2	14 3/4	15
12"	15 5/8	15 15/16	16 1/4	16 1/2	16 3/4	17 1/16	17 7/16	17 3/4	18
14"	18 1/4	18 9/16	18 15/16	19 1/4	19 9/16	19 7/8	20 3/8	20 11/16	21
16"	20 7/8	21 1/4	21 5/8	22	22 3/8	22 3/4	23 1/4	23 5/8	24
18"	23 1/2	23 7/8	24 5/16	24 3/4	25 3/16	25 5/8	26 3/16	26 9/16	27
20"	26 1/8	26 9/16	27	27 1/2	27 15/16	28 7/16	29 1/16	29 1/2	30
24"	31 5/16	31 7/8	32 7/16	33	33 9/16	34 1/8	34 7/8	35 7/16	36

	FLANGED	SCREWED	BELL AND SPIGOT	WELDED	SOLDERED
BUSHING		Å	<u>6∉ 4</u>	<u>×  </u> ×	- <del>qp</del> -
САР			$\longrightarrow$		
CROSS REDUCING	2 6 <del>=</del> 6 <del></del> + 4	6+6 +4	2 6 ¥ 6 ★ 4	6 <del>2</del> 6 × 4 × 4	2 6 ⊕ 6 ⊖ ⊕ 0 ⊕ 4
STRAIGHT SIZE	* ****	++++	÷	* * *	$\Theta \Theta \Theta$
CROSSOVER		++	ۍ~€		
ELBOW 45-DEGREE	↓ ↓	Ţ	Le L	*	6
90-DEGREE	_ ₽	ſ	Ę	**	6
TURNED DOWN	<b>G</b> -+	G <del>_ i</del>	<b>⊖</b> ⊸€	<b>⊖</b> →	$\ominus$
TURNED UP	<b>⊙</b> _#	$\Theta \rightarrow$	$\Theta \rightarrow$	<b>⊖</b> —×	⊖•
BASE	╄	Ť~_+	J.		
DOUBLE BRANCH	<b>#</b> ¥	++			
LONG RADIUS	<b>↓</b> <b>↓ ↓ ↓ . ℝ</b> .	↓ L.R.			

		FLANGED	SCREWED	BELL AND SPIGOT	WELDED	SOLDERED
ELBOW (CC REDUCIN	ONT'D) IG	2 4 4	2 4		2 4 *	<b>2</b> 0 <b>4</b> 0
SIDE OUT (OUTLET D	LET OWN)	<b>0</b> -∎ ₩	<b>↔</b> ↓	œ-€ Å		
SIDE OUT (OUTLET	LET UP)	⊕+ +	⊕_+ ↓	œ-€ ≜		
STREET	г		ţ,			
JOINT CONNECT PIPE	ING		<u> </u>		<b>_</b> *_	———————
EXPANSI	Л	╞══╋	⊨==	ᆂᆍ	<b>⋇</b> ⇒×	œ⊒₽
LATERA	L	₹*	ľ	Je	**	
ORIFACE F	PLATE					
REDUC FLAN	ING Ge	$\square$				
PLUGS BULL PL	UG	₽		þ		
PIPE PLI	JG				¢	
		-1>+			✻≫	-a⊃o-
ECCENT	RIC	- <b> </b>	4		✻╯ӿ	€∕₽

	FLANGED	SCREWED	BELL AND SPIGOT	WELDED	SOLDERED
SLEEVE	-##-	-+ <b> </b>	<b>→</b> ←	<u></u>	
TEE STRAIGHT SIZE	# <b>†</b> #	<del>, Ť ,</del>	₊ـــد	× <sup>*</sup> ×	olo
(OUTLET UP)	<b>+</b> O- <b>+</b>	++	÷-⊙-€	<b>∗</b> -⊙-×	•⊙•
(OUTLET DOWN)	*0*	+++++	$\rightarrow \bigcirc \bullet$	<del>* () *</del>	<del>000</del>
DOUBLE SWEEP	<b>₽</b> ₽₽	₊Ť₊			
REDUCING	2 + 6 4	2 1 6 4	2 4 6 4	2 * 6 4	2 ⊕ 6 4
SINGLE SWEEP	**	++			
SIDE OUTLET (OUTLET DOWN)	₦₫₦	۰	؞ڴۥ		
SIDE OUTLET (OUTLET UP)	<b>#⊙</b> #	+⊙+	٠Ŏ٠		
UNION	-#	+		— <del>XIX</del> —	<del>00</del>
ANGLE VALVE CHECK, ALSO ANGLE CHECK	*	<b>↓</b>	*	* *	0
GATE, ALSO ANGLE GATE (ELEVATION)	₽			××	

	FLANGED	SCREWED	BELL AND SPIGOT	WELDED	SOLDERED
GATE, ALSO ANGLE GATE (PLAN)	$\mathbb{P}$	$\widehat{\P}$		⊘₩	
GLOBE, ALSO ANGLE GLOBE (ELEVATION)	<u></u> ∠ T	A <sup>⊂</sup>		Å. ¥	¢¢¢
GLOBE (PLAN)	⊴⊢	Ø⊢		G₩	Ø₽
AUTOMATIC VALVE BY-PASS	<b>∑</b> ₽				
GOVERNOR- OPERATED					
REDUCING	<u></u>				
CHECK VALVE (STRAIGHT WAY)	╧	4	<b>∱</b> ∕4	-*~*	-a~-b
соск	-+ ( □ ⊨	⊣♡⊢	→ [] (-	-≫Ū́⊳–	а₿р
DIAPHRAGM VALVE	₽	₽			
FLOAT VALVE				*	
GATE VALVE*	$\triangleleft$	$\triangleleft$	$\rightarrow$	<b>*</b>	-a> <b< th=""></b<>



## COATED ARC WELDING ELECTRODES

- Types or Styles

### A.W.S. Classification

- E 6010 Direct Current, Reverse Polarity, All Positions All purpose. Moderately smooth finish. Good Penetration. (This is the rod used for most carbon steel pipe welding.)
- E 60**11 Alternating Current, All Positions.** All purpose. Moderately smooth finish. Good Penetration.
- E 60**12 Direct Current, Straight Polarity, All Positions.** High Bead. Smooth. Fast. "Cold Rod".
- E 6013 Alternating Current, All Positions. High Bead. Smooth. Fast. "Cold Rod".
- E 60**15 Direct Current, Reverse Polarity, All Positions.** "Low Hydrogen Rod".
- E 6016 Direct Current or Alternating Current, All Positions. "Low Hydrogen Rod".
- E 60**20 Direct Current, Straight Polarity, Flat Position Only.** Flat Bead. Smooth. Fast. Deep Penetration. Can be used with A.C. also "Hot Rod".
- E 6024 Direct Current, Straight Polarity or Alternating Current and Flat Position Only.
- E 6027 Flat Bead. Smooth. Fast. Deep Penetration. "Iron Powder Rods".

#### NOTE:

This information also applies to **E70**, **E80**, **E90**, and **E100** Series. The last two numbers (in bold type) designate the types or styles and the first two numbers the minimum specified tensile strength in 1000 psi of the weld deposit as welded.

## PHYSICAL PROPERTIES OF E60 AND E70 SERIES ELECTRODES

AWS - AS <sup>-</sup> ELECTRO	tm tens. De strength	YIELD STRENGTH	ELONGATION	RED. IN AREA MIN. %
		TYPICAL VA	LUES	
E6010	62,000-70,000	52,000-58,000	22 to 28%	35
E6011	62,000-73,000	52,000-61,000		
E6012	68,000-78,000	55,000-65,000	17 to 22%	25
			ALUES	
E7010	70,000	57,000		22
E7011	70,000	57,000		22
E7015	70,000	57,000		22
E7016	70,000	57,000	22	
E7020	70,000	52,000		25

#### WELDING AND BRAZING TEMPERATURES

Carbon Steel Welding	2700-2790°F
Stainless Steel Welding	2490-2730°F
Cast Iron Welding	1920-2500°F
Copper Welding and Brazing	1980°F
Brazing Copper-Silicon with Phosphor-Bronze	1850-1900°F
Brazing Naval Bronze with Manganese Bronze	1600-1700°F
Silver Solder	1175-1600°F
Low Temperature Brazing	1175-1530°F
Soft Solder	200-730°F
Wrought Iron	2700-2750°F

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Trouble	Cause	Remedy
	Power Circuit dead.	Check voltage.
	Broken Power Lead.	Repair.
	Wrong supply voltage.	Check nameplate against supply.
Welder will not start	Open Power Switches.	Close.
(Starter not operating)	Blown Fuses.	Replace.
	Overload Relay tripped.	Let set cool. Remove cause of overload.
	Open circuit to starter button.	Repair.
	Defective operating Coil.	Replace.
	Mechanical obstruction in Contactor.	Remove.
	Wrong Motor connections.	Check connection diagram.
	Wrong supply voltage.	Check nameplate against supply.
	Rotor stuck.	Try turning by hand.
Velder will not start	Power Circuit single-phased.	Replace fuse; repair open line.
(orallel not operating)	Starter single-phased.	Check contact of starter tips.
	Poor Motor connection.	Tighten.
	Open circuit in windings.	Repair.
	Fuse too small.	Should be two to three times rated motor circuit.
starter operates and blows fuse	Short circuit in motor connections.	Check starter and motor leads for insulation from ground and from each other.

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Trouble	Cause	Remedy
	Wrong Relay Heaters.	Renewal part recommendations.
Welder runs but	Welder overloaded.	Considerable averload can be carried only for a short time.
soon stops	Duty cycle too high.	Do not operate continually at overload currents.
	Leads too long or too narrow in cross section.	Should be large enough to carry welding current without excessive voltage drop.
	Power Circuit single-phased.	Check for one dead fuse or line.
	Ambient temperature to high.	Operate at reduced loads where temperature exceeds 100° F.
-	Ventilation blocked.	Check air inlet and exhaust openings.
Welding arc is	Current setting too high.	Check setting and output with ammeter.
loud and spatters excessively	Polarity wrong.	Check polarity, try reversing, or an electrode of opposite polarity.
	Current too low.	Check output, and current recommended for electrode being used.
welding arc sluggish	Poor connections.	Check all electrode-holder, cable, and ground- cable connections. Strap iron is poor ground return.
	Cable too long or too small.	Check cable voltage drop and change cable.
Touching set gives shock	Frame not grounded. or open circuited.	Ground solidly.
Generator control falls to varycurrent	Any part of field circuit may be short circuited	Find faulty contact and repair

Trouble	Cause	Remedy
	Wrong direction of rotation.	See INITIAL STARTING.
	Brushes worn or missing.	Check that all brushes bear on commutator with sufficient tension.
	Brush connections loose.	Tighten.
Welder starts but will not deliver welding current	Open field circuit.	Check connection to rheostat, resistor, and auxiliary brush studs.
	Series field and armature circuit open.	Check with test lamp or bell ringer.
	Wrong driving speed.	Check nameplate against motor speed or belt drive.
	Dirt, grounding field coils.	Clean and reinsulate.
	Welding terminal shorted.	Electrode holder or cable grounded.
	Electrode or ground connection loose.	Clean and tighten all connections.
	Poor ground.	Check ground-return circuit.
Welder generating but	Brushes worn off.	Replace with recommended grade. Sand to fit. Blow out carbon dust.
current falls off	Weak brush spring pressure.	Replace or readjust brush springs.
when welding	Brush not properly fitted.	Sand brushes to fit.
	Brushes in backwards.	Reverse.
	Wrong brushes used.	Renewal part recommendations.
	Brush pigtails damaged.	Replace brushes.
	Rough or dirty commutator.	Turn down or clean commutator.
	Motor connection single-phased.	Check all connections.

**TROUBLE-SHOOTING TIPS FOR ARC WELDING** 



Dearman Cat. No. D233 - 10"-36"



Dearman Cat. No. D235 - 10"-36"

### **COMMERCIAL PIPE SIZES CHART**

				Nominal	Wall Thick	ness For		
Pipe Size In Inches	O.D. In Inches	Sched. 10	Sched. 20	Sched. 40	Sched. 80	Sched. 120	Sched. 160	XX Strong
1/8	0.405	0.049	-	0.068	0.095	-	-	-
1/4	0.540	0.065	-	0.088	0.119	-	-	-
3/8	0.675	0.065	-	0.091	0.126	-	-	-
1/2	0.840	0.083	-	0.109	0.147	-	0.188	0.294
3/4	1.050	0.083	-	0.113	0.154	-	0.219	0.308
1	1.315	0.109	-	0.133	0.179	-	0.250	0.358
1 1/4	1.660	0.109	-	0.140	0.191	-	0.250	0.382
1 1/2	1.900	0.109	-	0.145	0.200	-	0.281	0.400
2	2.375	0.109	-	0.154	0.218	-	0.344	0.436
2 1/2	2.875	0.120	-	0.203	0.276	-	0.375	0.552
3	3.5	0.120	-	0.216	0.300	-	0.438	0.600
3 1/2	4.0	0.120	-	0.226	0.318	-	-	0.636
4	4.5	0.120	-	0.237	0.337	0.438	0.531	0.674
5	5.563	0.134	-	0.258	0.375	0.500	0.625	0.750
6	6.625	0.134	-	0.280	0.432	0.562	0.719	0.864
8	8.625	0.148	0.250	0.322	0.500	0.719	0.906	0.875
10	10.75	0.165	0.250	0.365	0.594	0.844	1.125	1.000
12	12.755	0.180	0.250	0.046	0.688	1.000	1.312	1.000
14 O.D.	14.0	0.250	0.312	0.438	0.750	1.094	1.406	-
16 O.D.	16.0	0.250	0.312	0.500	0.844	1.219	1.594	-
18 O.D.	18.0	0.250	0.312	0.562	0.938	1.375	1.781	-
20 O.D.	20.0	0.250	0.375	0.594	1.031	1.500	1.969	-
24 O.D.	24.0	0.250	0.375	0.688	1.218	1.812	2.344	-
28 O.D.	28.0	0.312	0.500	-	-	-	-	-
30 O.D.	30.0	0.312	0.500	-	-	-	-	-
32 O.D.	32.0	0.312	0.500	0.688	-	-	-	-
36 O.D.	36.0	0.312	0.500	0.750	-	-	-	-
42 O.D.	42.0	0.312	-	-	-	-	-	-
48 O.D.	48.0	-	-	-	-	-	-	-

## HEAT LOSSES FROM HORIZONTAL BARE STEEL PIPE

(BTU per hour per linear foot at 70° room temperature.)

NOMINAL PIPE SIZE	HOT WATER (180 F)	STEAM 5 PSIG (20PSIA)
1/2	60	96
3/4	73	118
1	90	144
1 1/4	112	179
1 1/2	126	202
2	155	248
2 1/2	185	296
3	221	355
3 1/2	244	401
4	279	448

## TOTAL THERMAL EXPANSION OF PIPE MATERIAL IN INCHES 100 FEET ABOUT 32F°

TEMPERATURE	CARBON & CARBON MOLY STEEL	CAST IRON	COPPER	BRASS & BRONZE	WROUGHT IRON
32	0	0	0	0	0
100	0.5	0.5	0.8	0.8	.5
150	0.8	0.8	1.4	1.4	.9
200	1.2	1.2	2.0	2.0	1.3
250	1.7	1.5	2.7	2.6	1.7
300	2.0	1.9	3.3	3.2	2.2
350	2.5	2.3	4.0	3.9	2.6
400	2.9	2.7	4.7	4.6	3.1
450	3.4	3.1	5.3	5.2	3.6
500	3.8	3.5	6.0	5.9	4.1
550	4.3	3.9	6.7	6.5	4.6
600	4.8	4.4	7.4	7.2	5.2
650	5.3	4.8	8.2	7.9	5.6
700	5.9	5.3	9.0	8.5	6.1
750	6.4	5.8			6.7
800 850 900 950 1000	7.0 7.4 8.0 8.5 9.1	6.3   			7.2   

## **METAL WEIGHTS**

MATERIAL	CHEMICAL SYMBOL	WEIGHT IN LBS PER SQ IN	WEIGHT IN LBS PER CUBIC FOOT
ALUMINUM ANTIMONY BRASS BRONZE CHROMIUM	Al Sb  Cr	.093 .2422 .303 .320 .2348	160 418 524 552 406
COPPER GOLD IRON (mild) IRON (wrought) LEAD	Cu Au Fe Pb	.323 .6975 .260 .2834 .4105	558 1205 450 490 710
MANGANESE MERCURY MOLYBDENUM MONEL PLATINUM	Mn Hg Mo  Pt	.2679 .491 .309 .318 .818	463 849 534 550 1413
STEEL (mild) STEEL (stainless) TIN TITANIUM ZINC	Fe  Sn Ti Zn	.2816 .277 .265 .1278 .258	490 484 459 221 446

### COLORS AND APPROXIMATE TEMPERATURE FOR CARBON STEEL

Black Red	990°F
Dark Blood Red	1050°F
Dark Cherry Red	1175°F
Medium Cherry Red	1250°F
Full Cherry Red	1375°F
Ligh Cherry, Scaling	1550°F
Salmon, Free Scaling	1650°F
Light Salmon	1725°F
Yellow	1825°F
Light Yellow	1975°F
White	2220°F

### LIST OF ABBREVIATIONS

Abbreviations conform to the practice of the American National Standards Institute Abbreviations for Scientific and Engineering Terms, ANSI Z10.1.

abs.	Absolute
AGA	American Gas Standard
AISI	American Iron and Steel Institute
ASO	American Standard Organization (ASO)
*ANSI	American National Standards Institute
API	American Petroleum Institute
ASHRAE	American Society of Heating
	Refrigeration and Air Conditioning Engineers
ASME	American Society of Mechanical Engineers
ASTM	American Society for Testing Materials
avg.	Average
AWWA	American Water Works Association
AWS	American Welding Society
B & S	Bell and Spigot or Brown & Sharpe (gauge)
bbl.	Barrel
Btu.	British Thermal Unit
С	Centigrade
Cat	Catalogue
cfm.	Cubic feet per Minute
cfs.	Cubic feet per Second
CI	Cast Iron
CS	Cast Steel (Not recommended for abbreviation)
cu ft	Cubic Feet
cu in	Cubic Inch
C to F	Center to Face
Deg or °	Degree
°C	Degrees Centigrade
°F	Degrees Fahrenheit
diam.	Diameter
dwg	Drawing
ex-hy	Extra Heavy
F&D	Faced and Drilled
F	Fahrenheit
F to F	Face to Face
Fig	Figure
flg.	Flange
g	Gage or Gauge
gal	Gallon
galv	Galvanized

### (Continuation) - ABBREVIATIONS

gpm or	
gal per min	Gallons per minute
hex	Hexagonal
hg	Mercury
hr	Hour
IBBM	Iron Body Bronze (or Brass) Mounted
ID	Inside Diameter
IPS	Iron Pipe Size (now obsolete - see NPS)
kw	Kilowatt
lb	Pound
MI	Malleable Iron
max	Maximum
min	Minimum
Mfr	Manufacturer
mtd	Mounted
MSS	Manufacturers Standardization Society
	Society (of Valve and Fittings Industry)
NEWWA	New England Water Works Association
NPS	Nominal pipe size
	(formerly IPS for Iron Pipe Size)
OD	Outside Diameter
OS&Y	Outside Screw and Yoke
OWG	Oil, Water, Gas (see WOG)
psig	Pounds per square inch, Gage
red	Reducing
sched or sch	Schedule
scr	Screwed
sec	Seconds
SF	Semi finished
Spec	Specification
sq	Square
SSU	Seconds Saybolt Universal
Std	Standard
TXN or TRX	Transactions
WOG	Water, Oil, Gas (see OWG)
wt	Weight
WSP	Working Steam Pressure
IWP	Internal Water Pressure
XS	Extra Strong
XXS	Double Extra Strong

### PIPE FITTERS DEFINITIONS

**ALLOY STEEL:** A steel which owes its distinctive properties to elements other then carbon.

**AREA OF A CIRCLE:** The measurement of the surface within a circle. To find the area of a circle, multiply the product of the radius times the radius by Pi (3.1416). Commonly written  $A = \pi r^2$ .

**BRAZE WELD OR BRAZING:** A process of joining metals using a nonferrous filler metal or alloy, the melting point of which is higher than 800°F but lower than that of the metals to be joined.

**<u>BUTT WELD</u>**: A circumferential weld in pipe fusing the abutting pipe walls completely from inside wall to outside wall.

**<u>CARBON STEEL</u>**: A steel which owes its distinctive properties chiefly to the various percentages of carbon (as distinguished from the other elements) which it contains.

<u>**CIRCUMFERENCE OF A CIRCLE**</u>: The measurement around the perimeter of a circle. To find the circumference, multiply Pi (3.1416) by the diameter. (commonly written as  $\pi$ d.)

**<u>COEFFICIENT OF EXPANSION</u>**: A number indicating the degree of expansion or contraction of a substance.

The coefficient of expansion is not constant and varies with changes in temperature. For linear expansion it is expressed as the change in length of one unit of length of a substance having one degree rise in temperature. A Table of Expansion (See page 118 is generally used to determine expansion or contraction within a piping system.

**<u>CORROSION</u>**: The gradual destruction or alternation of a metal or alloy caused by direct chemical attack or by electrochemical reaction.

**<u>CREEP</u>:** The plastic flow of pipe within a system; the permanent set in metal caused by stresses at high temperatures. Generally associated with a time rate of deformation.

**DIAMETER OF A CIRCLE:** A straight line drawn through the center of a circle from one edge to the other. Equal to twice the radius.

**<u>DUCTILITY</u>**: The property of elongation, above the elastic limit, but under the tensile strength.

A measure of ductility is the percentage of elongation of the fractured piece over its original length.

**ELASTIC LIMIT**: The greatest stress which a material can withstand without a permanent deformation after release of the stress.

**EROSION:** The gradual destruction of metal or other material by the abrasive action of liquids, gases, solids or mixtures thereof.

#### (Continuation) - PIPE FITTERS DEFINITIONS

**RADIUS OF A CIRCLE:** A straight line drawn from the center to the extreme edge of a circle.

**SOCKET FITTING:** A fitting used to join pipe in which the pipe is inserted into the fitting. A fillet weld is then made around the edge of the fitting and the outside wall of the pipe at the junction of the pipe and fitting.

**SOLDERING:** A method of joining metals using fusible alloys, usually tin and lead, having melting points under 700°F.

**STRAIN:** Change of shape or size of a body produced by the action of a stress.

**<u>STRESS</u>**: The intensity of the internal, distributed forces which resist a change in the form of a body. When external forces act on a body they are resisted by reactions within the body which are termed stresses.

A <u>Tensile Stress</u> is one that resists a force tending to pull a body apart.

A <u>Compressive Stress</u> is one that resists a force tending to crush a body.

A <u>Shearing Stress</u> is one that resists a force tending to make one layer of a body slide across another layer.

A Torsional Stress is one that resists forces tending to twist a body.

**TENSILE STRENGTH:** The maximum tensile stress which a material will develop. The tensile strength is usually considered to be the load in pounds per square inch at which a test specimen ruptures.

**TURBULENCE:** Any deviation from parallel flow in a pipe due to rough inner walls, obstructions or directional changes.

<u>VELOCITY</u>: Time rate of motion in a given direction and sense. Usually expressed in feet per second.

<u>VOLUME OF A PIPE</u>: The measurement of the space within the walls of the pipe. To find the volume of a pipe, multiply the length (or height) of the pipe by the product of the inside radius times the inside radius by Pi (3.1416). Commonly written as  $V = h\pi r^2$ .

**WELDING:** A process of joining metals by heating until they are fused together, or by heating and applying pressure until there is a plastic joining action. Filler metal may or may not be used.

<u>YIELD STRENGTH</u>: The stress at which a material exhibits a specified limiting permanent set.

#### MAINTENANCE AND CARE OF DEARMAN TOOLS AND EQUIPMENT

Although the Dearman Equipment does not require any special kind of maintenance, there are *three basic principles to follow in the care of all well made equipment:* (1). Keep it clean, (2). Keep it oiled or greased; and (3). Use the tools reasonably.

(1). <u>Keep it clean</u> – It is understood that sometimes you can't avoid getting mud on the tools—that doesn't mean the tools will be completely ruined. However, the tools will do a better job if you do not throw them in the mud or dirt after use. When you are on a job, I would suggest that every time you remove a clamp from the pipe you try to develop the habit of laying the clamp on some boards, on top of the pipe, or back in the tool box. **Most of our tools are shipped in steel tool boxes for easy care and storage**.

(2). <u>Keep it oiled or greased</u> – Any moving part should be kept oiled or greased to permit free movement of the parts. A little oil around the crank of the Fine Adjustment on all clamps is advisable.

(3). Use the tools reasonably – Dearman Equipment is a set of refined tools made to some pretty rigid specifications and will stand up to fair treatment. Do not hammer on the chains, clamps, or adjustable parts. The instrumentation tools should not be thrown in the same tool boxes with the clamps or other heavy tools. The Jackscrews are heat treated and specially treated to protect them from arc splatter. Do not try to tighten the Jackscrews more than necessary to remove the high-lows. Never tighten the screws where there are no high-lows. If you have some difference in the I.D., you should distribute the difference evenly all the way around.

All Dearman Clamps are available to meet the **stainless steel** requirements of nuclear power plants. The Rim Type Clamp is made so it does not need any additional parts to make it meet this stainless steel requirement.

If you are planning to store the tools for a month or a season make sure they are clean, oiled or greased and neatly packed into the steel box. They will be ready for use whenever you take them from the box.

Dearman Equipment should provide you with many years of valuable service by simply keeping your tools clean, oiled and treating them with reasonable care.



Cat. No. D2250 - 1"- 8"

2000CAT:MODEL NO. ISNO. OFWEIGHTWIPPINGMETRIC SIZED2501"-8"3716103D2494"-16"72549103D2494"-16"72549103D25110"-36"985138103D25110"-36"985138103D25110"-36"985138103D25110"-36"260 HELI-ARC SPECIAL103103D250REPLACED 231 - 250 - 250 HELI-ARC SPECIAL103103D249REPLACED 232 - 249 - 249 HELI-ARC SPECIAL103103D251AVAILABLE NO SIZES TO 20'AVAILABLE NO SPECIAL103D251AVAILABLE NO SIZES TO 20'100103D251AVAILABLE NO SIZES TO 20'100103D251AVAILABLE NO SIZES TO 20'100103D251AVAILABLE NO SIZES TO 20'100103D251AVAILABLE NO SIZES TO 20'100	*All previous size clamps are still available.	D251 AVAILABLE IN SIZES TO 20'	D235 REPLACED 235 - 234 - 235 - 236 HELI-ARC SPECIAL	D249 REPLACED 232 - 249 - 249 HELI-ARC SPECIAL	D250 REPLACED 231 - 250 - 250 HELI-ARC SPECIAL	D251 10"-36" AVAILABLE UP TO 20' 103	D235 10"-36" 9 85 138 103	D249 4"-16" 7 25 49 103	D250 1"-8" 3 7 16 103	CAT. MODEL NO. IS NO. OF WEIGHT SHIPPING METRIC SIZES NO. PIPE SIZE JACKBARS LBS. WEIGHT ON PAGE	2000
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CATALOG AND MODEL NUMBERS DEARMAN PIPE WELDING CLAMP SERIES

## DEARMAN PRODUCTS-PART NUMBER AND SPECIFICATION CHARTS

DEARMAN RIM-TYPE	<b>REFORMING CLAMP</b>
Catalog	# D711

MODEL NO. IS PIPE SIZE	WEIGHT	CUBIC FEET	METRIC SIZE ON PAG
4" - 6"	40	2	103
6" - 8"	50	2	103
8" - 10"	70	3	103
10" - 12"	90	3	103
12" - 14"	120	4	103
14" - 16"	190	5	103
16" - 18"	240	6	103
18" - 24"	360	7	103
20" - 26"	380	9	103
22" - 28"	400	10	103
26" - 32"	420	12	103
30" - 36"	420	14	103
34" - 45"	450	17	103
38" - 44"	490	20	103
42" - 48"	510	24	103
44" - 50"	575	26	103
46" - 52"	610	28	103
50" - 56"	680	34	103
54" - 60"	750	37	103
58" - 64"	820	41	103
66" - 72"	950	43	103

Above 72" upon request.

#### (CONTINUED.) DEARMAN PRODUCTS-PART NUMBER AND SPECIFICATION CHARTS

### DEARMAN HEAVY DUTY ADJUSTABLE PIPE VESSEL CLAMP Catalog # D251

MODEL NO. IS PIPE SIZE	NO. OF JACKBARS	APPROX. WEIGHT	
10"-36"	9	170	
10"-48"	12	222	
10"-54"	14	250	
10"-60"	16	278	
10"-72"	20	337	
10"-84"	24	392	
10"-96"	28	448	
10"-120"	36	560	
10"-11'	39	610	
10"-12'	42	660	
10"-14'	48	760	
10"-16'	54	860	
10"-18'	60	960	
10"-20'	66	1060	

### Hold Down Clamp Catalog No. D244 - D245

- Holds pipe secure
- Minimum interference of working area
- Simple two-step installation
- Light weight
- Mobile
- Also available in Stainless Steel

Order by Catalog Number, important: If wanted for Stainless Steel pipe, specify by adding SS (Stainless Steel) to Catalog Number (i.e. 244SS).

Catalog Number	Item	Adjustment Size	Shipping Weight	Chain Size
D244	Hold Down Clamp	2" to 16"	5lbs.	3 / 16"
D245	Hold Down Clamp	10" to 48"	14lbs.	1/4"



#### Flange Spreader Catalog No. D100

Weight: 11lbs. Shipping Weight: 13lbs. Metal: Carbon Steel

Eliminates hammering and hassle of maintenance on new and old pipe on the insertion of gaskets, with no wedges flying off or flying sparks.

2" thru 12" flange - 300 lbs. flanges large sizes by request.

The Slide Pins expand apart for a variety of flange sizes. The Wedge extends to a capacity of 1 1/4" and the Flange Spreader easily attaches to the flange holes. With 100 lb. torque you get up to 12,000 lbs. spreading force.

Hydraulic and larger versions for flanges up to 36" (914 mm) available. Visit mathey.com for information.



The Large Protractor will measure squareness of pipe ends up to 40" / 1016mm diameter or can be used to check large pipe miter angles up to  $180^{\circ}$ .

Accurate to any degree the Dearman Protractor is the most flexible protractor available. Checks accurate miter of pipe to any degree.

This protractor is scaled large enough to be used with the largest pipe. For those large jobs, the versatility of this protractor makes it extremely useful. The protractor includes 2 blades (36" & 48"). Larger blades can be furnished for larger dimension on request.



For use on smaller pipe. Easy to check any degree. Complete with printed instructions on back of protractor blades.

#### MINI Stainless Steel Protractor Catalog No. DXX-250

Weight: .3lbs. Shipping Weight: .2lbs. Size: One 6" Blade Metal: Stainless Steel



For use on smaller pipe.

Mini Protractor can be used for a variety of applications including measuring the torch bevel angle and measuring degree of bevel.

### Pipe Fitter's Square Catalog No. D248

Weight: 1lbs. Shipping Weight: 1.9lbs. Size: One 16" Blade Metal: Stainless Steel

- Marked in Pipe Cuts.
- Comes with 30 Page Illustrated Instructions for use.



This Square is marked in pipe fitting and pipe cuts instead of carpenter cuts. Deeply etched markings for easy reading and durability. Instruction book is included with each square.





#### Chain Clamp Cat. No. D2249 Model No. 4"-16"

Chain Clamp Cat. No. D2235 Model No. 10"-36" \*This Clamp is available in sizes up to 36 inches.

Model	Main Block	Jackbar	Qty. of Jackbars Req.	Fine Ad- justment	Chain	Feet of Chain Req.	Level and Support	Connect- ing Link
NLA	DXL-524	DXL-523	2	DXL-200	DA-300	1.7	N/A	DA-301
D230-ASS	DXL-524	DXL-523S	2	DXL-200	DA-300S	1.7	N/A	DA-301
D230	DXL-524	DXL-523	2	DXL-200	DA-300	2.7	N/A	DA-301
D230-SS	DX-524	DXL-523S	2	DXL-200	DA-300S	2.7	N/A	DA-301
D231	DA-100	DA-500S	3	DA-200	DA-300	2.7	DA-400	DA-301
D231SS	DA-100	DA-500S	3	DA-200	DA300S	2.7	DA-400	DA-301S
D231LT	DXL-524	DXL-523	5	DXL-200	DA-300	4	N/A	DA-301
D232	DB-100	DB-500S	7	DB-200	DB-300	5	DB-400	DB-301
D232SS	DB-100	DB-500S	7	DB-200	DB-300S	5	DB-400	DB-301S
D232LT	DA-100	DA-500S	7	DA-200	DA-300	7	DA-400	DA-301
D232LTSS	DA-100	DA-500S	7	DA-200	DA-300S	7	DA-400	DA-301S
D233	DC-100	DC-500S	8	DC-200	DC-300	10	DC-400	DC-301
D233SS	DC-100	DC-500S	8	DC-200	DC-300S	10	DC-400S	DC-301S
D233LT	DB-100	DB-500S	10	DB-200	DB-300	10	DB-400	DB-301
D233LTSS	DB-100	DB-500S	10	DB-200	DB-300S	10	DB-400	DB-301S
D234	DC-100	DC-500S	13	DC-100	DC-300	15	DC-400	DC-301
D234SS	DC-100	DC-500S	13	DC-100	DC-300S	15	DC-400S	DC-301S
D250	DA-100	DA-600S	3	DA-200	DA-300	2.7	DA-400	DA-301
D250SS	DA-100	DA-600S	3	DA-200	DA-300S	2.7	DA-400	DA-301S
D249	DB-100	DB-600S	7	DB-200	DB-300	5	DB-400	DB-301
D249SS	DB-100	DB-600S	7	DB-200	DB-300S	5	DB-400	DB-301S
D249LT	2DA-100	DA-600S	7	DA-200	DA-300	7	DA-400	DA-301
D249LTSS	DA-100	DA-600S	7	DA-200	DA-300S	7	DA-400	DA-301S
D235	DC-100	DC-600S	8	DC-200	DC-300	10	DC-400	DC-301
D235SS	DC-100	DC-600S	8	DC-200	DC-300S	10	DC-400S	DC-301S
D235LT	DB-100	DB-600S	8	DB-200	DB-300	10	DB-400	DB-301
D235LTSS	DB-100	DB600S	8	DB-200	DB-300S	10	DB-400	DB-301S
D236	DC-100	DC-600S	13	DC-200	DC-300	15	DC-400	DC-301
D236SS	DC-100	DC-600S	13	DC-200	DC-300S	15	DC-400S	DC-301S
D2250	DA-100	DA-800	3	DA-200	DA-300	2.7	DA-400	DA-301
D2250SS	DA-100	DA-800	3	DA-200	DA-300S	2.7	DA-400	DA-301S
D2249	DB-100	DB-800	7	DB-200	DB-300	5	DB-400	DB-301
D2249SS	DB-100	DB-800	7	DB-200	DB-300S	5	DB-400	DB-301S
D2235	DC-100	DC-800	8	DC-200	DC-300	10	DC-400	DC-301
D2235SS	DC-100	DC-800	8	DC-200	DC-300S	10	DC-400S	DC-301S

## **Chain Clamp Assembly**



# Dearman Light Main Block

Description	Part Number
1" - 8" Carbon Steel	DXL-524
1" - 8" Stainless Steel	DXL-524S
1" - 12" Carbon Steel (Light Chain Clamp)	DXL-524
1" - 12" Stainless Steel (Light Chain Clamp)	DXL-524S



Standard & Light Main Block

Description	Part Number
1" - 8"	DA-100
4" - 20" (Light Chain Clamp)	DA-100LT
4" - 16"	DB-100
6" - 36" (Light Chain Clamp)	DB-100LT
10"- 36" & 10" - 54"	DC-100



## **D251 Series Double Chain Main Block**

Description	Part Number
D251 Series Carbon Steel	DD-100
D251 Series Stainless Steel	DD-100S



## Mini-Fit Single Screw Jackbar

Description	Part Number
1" - 8" Carbon Steel	DXL-523
1" - 8" Stainless Steel	DXL-523S
1" - 12" Carbon Steel (Light Chain Clamp)	DXL-523
1" - 12" Stainless Steel (Light Chain Clamp)	DXL-523S



# Single Screw Jackbar

Description	Part Number
1" - 8"	DA-500S
4" - 20" (Light Chain Clamp)	DA-500S
4" - 16"	DB-500S
6" - 36" (Light Chain Clamp)	DB-500S
10" - 36" & 10" - 54"	DC-500S



## **Double Screw Jackbar**

Description	Part Number
1" - 8"	DA-600S
4" - 20" (Light Chain Clamp)	DA-600S
4" - 16"	DB-600S
6" - 36" (Light Chain Clamp)	DB-600S
10" - 36" & 10" - 54"	DC-600S



## **Universal Jackbar**

Description	Part Number
1" - 8"	DB-800
4" - 16"	DB-800
10" - 36" & 10" - 54"	DC-800



Add-On Jackbar

Description	Part Number
1" - 8"	DA-900
4" - 16"	DB-900
10" - 36" & 10" - 54"	DC-900



## **Double Screw Jackbar**

Description	Part Number
D251 Series Carbon Steel	DD-500
D251 Series Stainless Steel	DD-500S



## **Mini-Fit Jackscrews**

Description	Part Number
1" - 8" Carbon Steel	DXL-525
1" - 8" Stainless Steel	DXL-525S
1" - 12" Carbon Steel	DXL-525
1" - 12" Stainless Steel	DXL-525S



## Jackscrews

Description	Part Number
1" - 8"	DA-501
4" - 16"	DA-701
10" - 36" & 10" - 54"	DC-501



# Fine Adjustment

Description	Part Number
1" - 8"	DA-200
4" - 20"	DA-200LT
4" - 16"	DB-200
6" - 36"	DB-200LT
10" - 36" & 10" - 54"	DC-200



# Level & Support Device

Description	Part Number
1" - 8"	DA-400S
4" - 20" (Light Chain Clamp)	DA-400SLT
4" - 16"	DB-400S
6" - 36" (Light Chain Clamp)	DB-400SLT
10" - 36" & 10" - 54"	DC-400
D251 Series Carbon Steel	DC-400
D251 Series Stainless Steel	DC-400S



# **Roller Chain**

Description	Part Number
1" - 8" Carbon Steel	DA-300
1" - 8" Stainless Steel	DA-300S
4" - 20" Carbon Steel (Light Chain Clamp)	DA-300
4" - 20" Stainless Steel (Light Chain Clamp)	DA-300S
4" - 16" Carbon Steel	DB-300
4" - 16" Stainless Steel	DB-300S
6" - 36" Carbon Steel (Light Chain Clamp)	DB-300
6" - 36" Stainless Steel (Light Chain Clamp)	DB-300S
10" - 36" & 10" - 54" Carbon Steel	DC-300
10" - 36" & 10" - 54" Stainless Steel	DC-300S
D251 Series Carbon Steel	DC-300
D251 Series Stainless Steel	DC-300S


### **Roller Chain Connecting Link**

Description	Part Number
1" - 8" Carbon Steel	DA-301
1" - 8" Stainless Steel	DA-301S
4" - 20" Carbon Steel (Light Chain Clamp)	DA-301
4" - 20" Stainless Steel (Light Chain Clamp)	DA-301S
4" - 16" Carbon Steel	DB-301
4" - 16" Stainless Steel	DB-301S
6" - 36" Carbon Steel (Light Chain Clamp)	DB-301
6" - 36" Stainless Steel (Light Chain Clamp)	DB-301S
10" - 36" & 10" - 54" Carbon Steel	DC-301
10" - 36" & 10" - 54" Stainless Steel	DC-301S
D251 Series Carbon Steel	DC-301
D251 Series Stainless Steel	DC-301S



### **Universal Spacing Tool**

Description	Part Number
1" - 8" Carbon Steel	DA-870
1" - 8" Stainless Steel	DA-870S
4" - 20" Carbon Steel (Light Chain Clamp)	DA-870
4" - 20" Stainless Steel (Light Chain Clamp)	DA-870S
4" - 16" Carbon Steel	DB-870
4" - 16" Stainless Steel	DB-870S
6" - 36" Carbon Steel (Light Chain Clamp)	DB-870
6" - 36" Stianless Steel (Light Chain Clamp)	DB-870S
10" - 36" & 10" - 54" Carbon Steel	DC-870
10" - 36" & 10" - 54" Stainless Steel	DC-870S
D251 Series Carbon Steel	DC-870
D251 Series Stainless Steel	DC-870S



### Jackbar Spacing Tool

Description	Part Number
1" - 8" Carbon Steel	DA-570
1" - 8" Stainless Steel	DA-570S
4" - 20" Carbon Steel (Light Chain Clamp)	DA-570
4" - 20" Stainless Steel (Light Chain Clamp)	DA-570S
4" - 16" Carbon Steel	DB-570
4" - 16" Stainless Steel	DB-570S
6" - 36" Carbon Steel (Light Chain Clamp)	DB-570
6" - 36" Stianless Steel (Light Chain Clamp)	DB-570S
10" - 36" & 10" - 54" Carbon Steel	DC-570
10" - 36" & 10" - 54" Stainless Steel	DC-570S
D251 Series Carbon Steel	DC-570
D251 Series Stainless Steel	DC-570S

### ENGLISH STYLE THE DEARMAN SYSTEM OF CHECKING HIGH-LOW DURING FIT-UP

**DESCRIPTION:** The Dearman Method of checking "high-low on small fittings is usually visual. When a fit is such that visual checking is impossible, the Dearman Q.C. Gauge is used.

#### APPLICATION

STEP 1. To check the highi-low of your fit-up with the inside Gauge, Q.C. loosen the retaining screw. Press the legs beyond the housing of the gauge and insert them into the space between the two pieces to be fit-up. Rotate the gauge one quarter turn, applying a pulling pressure to the housing. Hold square with the pipe as as possible. Tighten the Retaining Screw. Reverse guarter turn to remove gauge.

**STEP 2.** Read the fractional gauge across the red line. When the red line and the one-thirty-second line match up, you have a perfect fit-up. This is the zero point. Each mark on the gauge from the zero point represents 1/32 of an inch of high-low. The other fractional markings are only used when the gauge is used for checking space.

Quality Control (Q.C.) Gauge Cat. No. D253E English Style



**STEP 3.** Read the gauge. It is marked in one mm. The marks on the gauge should show the same reading in several places around the fit-up, the larger the fitting, the more places you must check the high-low. Check four places for pipe up to six inches, then it will depend on the size of the pipe and how much it is out of round as to how many additional places must be checked.

#### (CONTINUED.) ENGLISH STYLE

#### Quality Control (Q.C.) Gauge Cat. No. D253E English Style

Loosen the Retainer Screw. Insert the Gauge between the pipe and fitting or two pieces of pipe. The leg with the short angle will rest on the level of the pipe. The leg with the long angle is extended until it makes contact with both sides of the space to be checked. Tighten Retaining Screw and remove Gauge and read.



The space dimension between the pieces being fitted can now be read in fractions of an inch.

#### METRIC STYLE THE DEARMAN SYSTEM OF CHECKING HIGH-LOW DURING FIT-UP

DESCRIPTION: The Dearman Method of checking high-low on small fittings is usually visual. When a fit is such that visual checking is impossible, the Dearman Q.C. Gauge is used.

#### APPLICATION

STEP 1. To check the high-low of your fit-up with the inside Q.C. Gauge. loosen the retainina screw. Press the leas beyond the housing of the gauge and insert them into the space between the two pieces to be fit-up. Rotate the one quarter aauae turn. applying a pulling pressure to the housing. Hold as square with the pipe as possible. Tighten the Retaining Screw. Reverse guarter turn to remove gauge.

**STEP 2.** Read the fractional gauge across the red line. When the red line and the one-thirty-second line match up, you have a perfect fit-up. This is the zero point. Each mark on the gauge from the zero point represents mm of high-low.

#### Quality Control (Q.C.) Gauge Cat. No. D253M Metric Style



**STEP 3.** Read the gauge. It is marked in inches 1/32 and 1/16. The marks on the gauge should show the same reading in several places around the fit-up, the larger the fitting, the more places you must check the high-low. Check four places for pipe up to six inches, then it will depend on the size of the pipe and how much it is out of round as to how many additional places must be checked.

#### (CONTINUED.) METRIC STYLE

#### Pit Depth Gauge Cat. No. D253M Metric Style

Loosen the retainer screw. Insert the gauge between the pipe and fitting or two pieces of pipe. The leg with the short angle will rest on the level of the pipe. The leg with the long angle is extended until it makes contact with both sides of the space to be checked. Tighten retaining screw and remove gauge and read.



The space dimensions between the pieces being fitted can now be read in millimeters. When reading the gauge for spacing, the numbered mm markings are in 1mm increments.

#### THE DEARMAN WELD HEIGHT, OUTSIDE HIGH-LOW,

#### PIT DEPTH GAUGE, CATALOG NO. D254

Slide the D254 gauge over the end of the gauge case that covers the inside high-low Wire Gauges. Holding the Q.C. Welders Gauge in your right hand, place it on the outside pipe surface. Using your forefinger, press down on the top of the extended point until the point comes in contact with the weld, the other pipe surface that is being fitted up, or the bottom of the pit being checked. Read the indicator. Each mark is equal to .4mm or 1/64 of an inch.





Measuring Outside High-Low

Cat. No. D254 OUTSIDE HIGH-LOW GAUGE THE GAUGE CAN BE USED IN CONJUNCTION WITH THE Q.C. GAUGE

## DECIMALS OF AN INCH FOR EACH 64TH OF AN INCH WITH MILLIMETER EQUIVALENTS

Frac- tion	1/64 ths	Deci- mal	Milli- meters (Approx.)	Frac- tion	1/64 ths	Deci- mal	Milli- me- ters (Approx.)
	1	.015625	0.397		33	.515625	13.097
1/32	2	.03125	0.794	17/32	34	.53125	13.494
	3	.046875	1.191		35	.546875	13.891
1/16	4	.0625	1.588	9/16	36	.5625	14.288
	5	.078125	1.984		37	.578125	14.684
3/32	6	.09375	2.381	19/32	38	.59375	15.081
	7	.109375	2.778		39	.609375	15.478
1/8	8	.125	3.175	5/8	40	.625	15.875
	9	.140625	3.572		41	.640625	16.272
5/32	10	.15625	3.969	21/32	42	.65625	16.669
	11	.171875	4.366		43	.671875	17.066
3/16	12	.1875	4.763	11/16	44	.6875	17.463
	13	.203125	5.159		45	.703125	17.859
7/32	14	.21875	5.556	23/32	46	.71875	18.256
	15	.234375	5.953		47	.734375	18.653
1/4	16	.250	6.350	3/4	48	.750	19.050
	17	.265625	6.747		49	.765625	19.447
9/32	18	.28125	7.144	25/32	50	.78125	19.844
	19	.296875	7.541		51	.796875	20.241
5/16	20	.3125	7.938	13/16	52	.8125	20.638
	21	.328125	8.334		53	.828125	21.034
11/32	22	.34375	8.731	27/32	54	.84375	21.431
	23	.359375	9.128		55	.859375	21.828
3/8	24	.375	9.525	7/8	56	.875	22.225
	25	.390625	9.922		57	.890625	22.622
13/32	26	.40625	10.319	29/32	58	.90625	23.019
	27	.421875	10.716		59	.921875	23.416
7/16	28	.4375	11.113	15/16	60	.9375	23.812
	29	.453125	11.509		61	.953125	24.209
15/32	30	.46875	11.906	31/32	62	.96875	24.606
	31	.484375	12.303		63	.984375	25.003
1/2	32	.500	12.700	1	64	1.000	25.400

#### WEIGHTS AND MEASURES UNITED STATES SYSTEM

	EINEAN MEADONE									
Inches		Feet		Yards		Rods		Furlongs		Miles
1.0	=	.083	333 =	.02778	3 =	.0050505	=	.000126226 =		.00001578
12.0	=	1.0	=	.33333	3 =	.0606061	=	.00151515 =		.00018939
36.0	=	3.0	=	1.0	=	.1818182	=	.00454545 =		.00056818
198.0	=	16.5	=	5.5	=	1.0	=	.025	=	.003125
7920.0	=	660.0	=	22	=	4	=	.1	=	.125
63360.0	=	5280.0	=	1760.0	= (	320.0	=	8.0	=	1.0

#### ------ LINEAR MEASURE -------

					-				
Sq. Inches	Square Ft.	Square Yds		Square Rods	Acres	Square Miles			
1.0 =	.006944 =	.000772							
144.0 =	1.0 =	.111111							
1296.0 =	9.0 =	1.0	=	.03306 =	.000207				
39204.0 =	272.25 =	30.25	=	1.0 =	.00625 =	.0000098			
43560.0 = 3	302.5 =	33.61	=	1.111 =	.0070				
		3097600.0	=	102400.0 =	640.0 =	1.0			

		AV	OIR	DUPUIS W	/EIG	HIS —		
Grains		Drams		Ounces		Pounds		Tons
1.0	=	.03657	=	.002286	=	.000143	=	.000000714
27.34375	=	1.0	=	.0625	=	.003906	=	.00000195
437.5	=	16.0	=	1.0	=	.0625	=	.00003125
7000.0	=	256.0	=	16.0	=	1.0	=	.0005
14000000.0	=	512000.0	=	32000.0	=	2000.0	=	1.0

#### - AVOIRDUROIS WEIGHTS -

DRY MEASURE								
Pints		Quarts		Pecks		Cubic Ft.		Bushels
1.0	=	.5	=	.0625	=	.01945	=	.01563
2.0	=	1.0	=	.125	=	.03891	=	.03125
16.0	=	8.0	=	1.0	=	.31112	=	.25
51.42627	=	25.71314	=	3.21414	=	1.0	=	.80354
		32.0	=	4.0	=	1.2445	=	1.0

LIQUID MEASURE								
Gills		Pints		Quarts		US Gallor	าร	Cubic Ft.
1.0	=	.25	=	.125	=	.03125	=	.00418
4.0	=	1.0	=	.5	=	.125	=	.01671
8.0	=	2.0	=	1.0	=	.250	=	.03342
32.0	=	8.0	=	4.0	=	1.0	=	.1337
						7.48052	=	1.0

AVOIRDUPOIS WEIGHTS- "Goods Sold by Weight" - "Goods of Weight"

#### WEIGHTS AND MEASURES METRIC SYSTEM UNITS

Leng	th - Meter : Mass for pure wate 1 Cubic decimeter	s - Gram er at 4°C. ( or 1 Liter:	<b>: Capactiy - L</b> 39.2°F.) = 1 Kilogram	iter
(meter 1000 Milli (grams (liter	s (mm) (mete ) (mg) ) = 100 Centi (grar s (ml) ) (lit	rs (cm) ) ns (cg) ) = ers (cl) )	(meters (dm) ) 10 Deci (grams (dg) ) (liters (dl) )	(meter) = 1 (gram) (liter)
(meter) 1000 (grams) = (liters)	(meters (dkm) ) 100 Deka (grams (dkg) ) (liters (dkl) )	( = 10 Hecto	meters (hm) ) (grams (hg) ) = 1 Ki (liters (hl) )	(meter (km) ) ilo (gram (kg) ) (liter (kl) )
	1 Metric Ton 100 Square Meters 100 Arces 100 Hectares	= = =	1000 Kilograms 1 Are 1 Hectare 1 Square Kilom	eter

### USEFUL MEASURES - U.S. AND METRIC

1 Foot = 12 Inches	10 Millimeters - 1 Centimeter
1 Yard = 3 Feet	10 Meters - 1 Dekameter
5,280 Feet = 1 Mile	1 Kilometer6214 Miles
1 Mile = 320 Rods	1 Meter - 39.37 Inches
1 Mile = 1760 Yards	5280 Feet - 1 Mile
1 Rod = 16.5 Feet	1 Rod - 16.5 Feet
1 Chain - 66 Feet	1 Mile - 1.6093 Kilometers
1 Furlong - 220 Yards	1 Statute Mile - 80 Chains
1 Nautical Mile - 6080 Feet	1 Foot3048 Meters
1 Link - 7.92 Inches	10 Centimeters - 1 Decimeter
1 Statute Mile = 80 Chains	10 Dekameter - 1
1 Inch - 2.54 Centimeters	Hectometer
1 Centimeter = .3937 Inches	1 Meter - 1000 Millimeters
	1 Meter - 3.2802 Feet

#### WEIGHTS AND MEASURES USEFUL MEASURES - U.S. AND METRIC

#### - VOLUME MEASURES -

1 Sq. Foot - 144 Inches	1 Township - 36 Sections
9 Sq. Feet - 1 Sq. Yard	100 Sq. Millimeters - 1 Sq. Centimeter
1 Sq. Yard - 1296 Sq. Inches	10,000 Sq. Centimeters - 1 Sq. Meter
1 Sq. Rod - 272 1/4 Sq. Feet	1,000,000 Sq. Meters - 1 Sq. Kilometer
1 Sq. Rod - 30 1/4 Sq. Yards	1 Sq. Inch - 6.4516 Sq. Centimeters
1 Acre - 43,560 Sq. Feet	1 Sq. Centimeter1550 Sq. Inches
1 Acre - 4840 Sq. Yards	1 Sq. Foot0929 Sq. Meters
1 Acre - 160 Sq. Rods	1 Sq. Meter - 10.7639 Sq. Feet
640 Acres - 1 Sq. Mile	1 Sq. Meter - 1.1960 Sq. Yards
640 Acres - 1 Section	

#### — MEASURE OF AREA —

1728 Cubic Inches - 1 Cubic Foot	1 Cubic Meter - 35.3145 Cubic Feet
27 Cubic Feet - 1 Cubic Yard	1 Cubic Foot0283 Cubic Meters
231 Cubic Inches - 1 Gallon	1 Cubic Meter - 1.3079 Cubic Yards
1 Ton (Shipping) - 40 Cubic Feet	1 Cubic Yard7646 Cubic Meters
1 Bushel - 2150.42 Cubic Inches	1000.27 Cubic Centimeters - 1 Liter
1 Cubic Centimeter - 1000 Cubic Millimeters	1 Gallon - 3.79 Liters
1,000,000 Cubic Centimeters - 1 Cubic Meter	1 Cubic Foot - 28.3162 Liters
1 Cubic Centimeter0610 Cubic Inches	1 Cubic Foot - 7.481 Gallons
1 Cubic Inch - 16.3872 Cubic Centimeters	

#### WEIGHTS AND MEASURES UNITED STATES SYSTEM

16 Ourses 1 Deund
(Avoirdupois)
12 Ounces - 1 Pound (Troy Weight - Gold Silver and Jewels)
2000 Pounds - 1 Short Ton
2240 Pounds - 1 Long Ton
1 Gallon of Water - 8-1/3 Pounds @ 62° F.
1 Cubic Foot of Water - 62-1/2 Pounds @ 62° F.

1 to 9		to 9	10	to 90	100	to 900	1,000	to 9,000	10,000 t	o 90,000
	Ft.	Miles	Ft.	Miles	Ft.	Miles	Ft.	Miles	Ft.	Miles
	1	0.00019	10	0.00189	100	0.01894	1,000	0.18939	10,000	1.8939
	2	0.00038	20	0.00379	200	0.03788	2,000	0.37879	20,000	3.7879
	3	0.00057	30	0.00568	300	0.05682	3,000	0.56818	30,000	5.6818
	4	0.00076	40	0.00758	400	0.07576	4,000	0.75758	40,000	7.5758
	5	0.00095	50	0.00947	500	0.09470	5,000	0.94697	50,000	9.4697
	6	0.00114	60	0.01136	600	0.11364	6,000	1.13636	60,000	11.3636
	7	0.00133	70	0.01326	700	0.13258	7,000	1.32576	70,000	13.2576
	8	0.00152	80	0.01515	800	0.15152	8,000	1.51515	80,000	15.1515
	9	0.00170	90	0.01705	900	0.17046	9,000	1.70455	90,000	17.0455

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THE DEARMAN SYSTEM HANDBOOK Mathey Dearman, Inc. © 2015

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