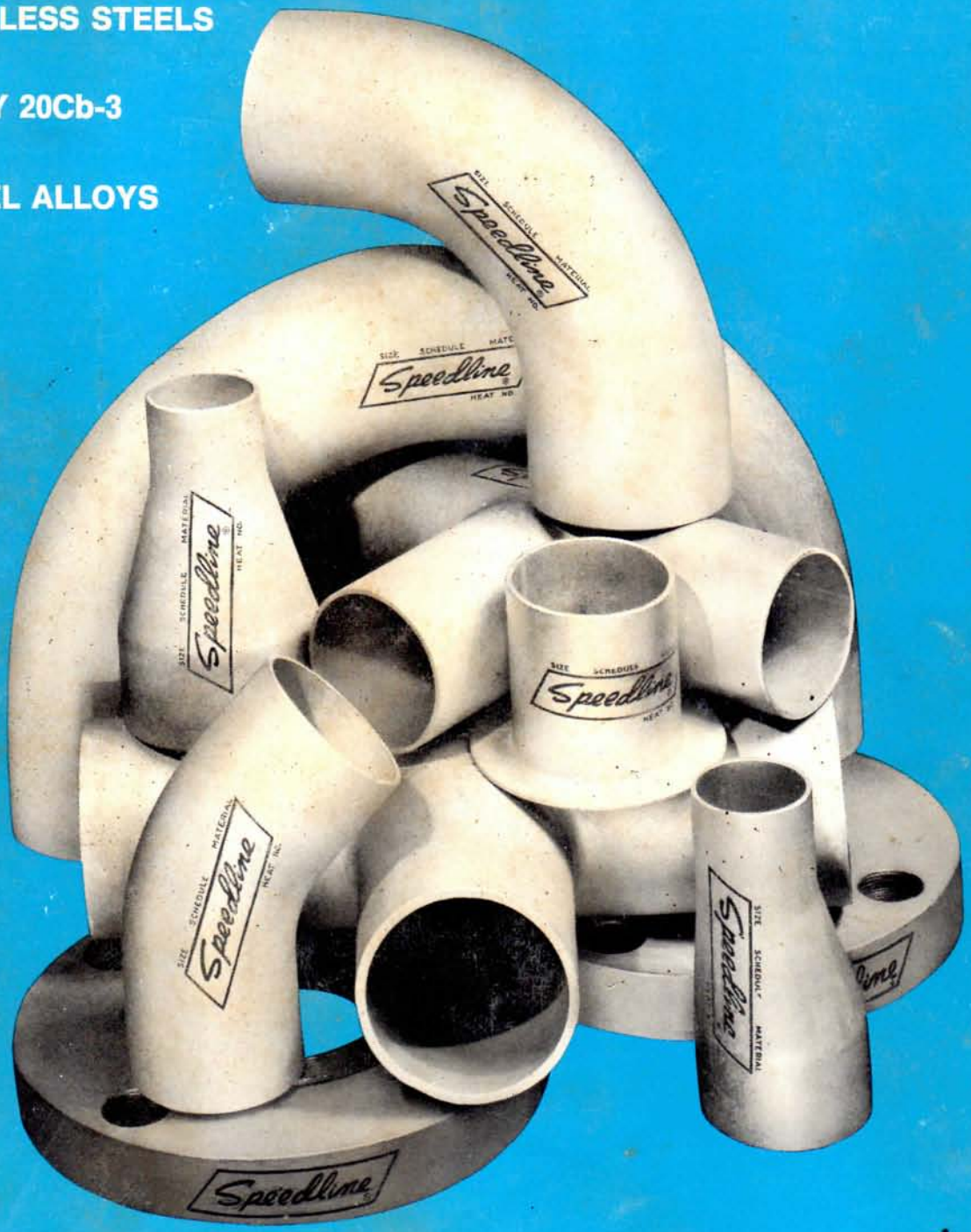
Speedline®

CORROSION RESISTANT PIPE FITTINGS

STAINLESS STEELS

ALLOY 20Cb-3

NICKEL ALLOYS



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A Product of

Speedline INC.®

Philadelphia, Pennsylvania

Speedline

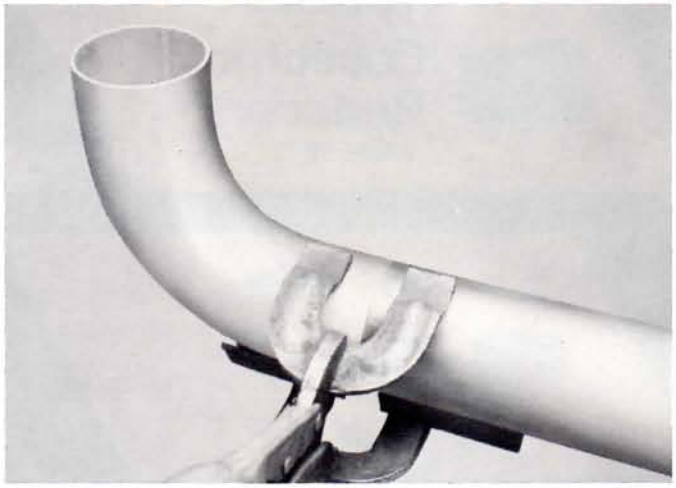
Unions

PAGE 27

TANGENTIAL DESIGN PROVIDES BUILT-IN ADVANTAGES AND VERSATILITY THAT SPEED PROCESS PIPE ASSEMBLY.

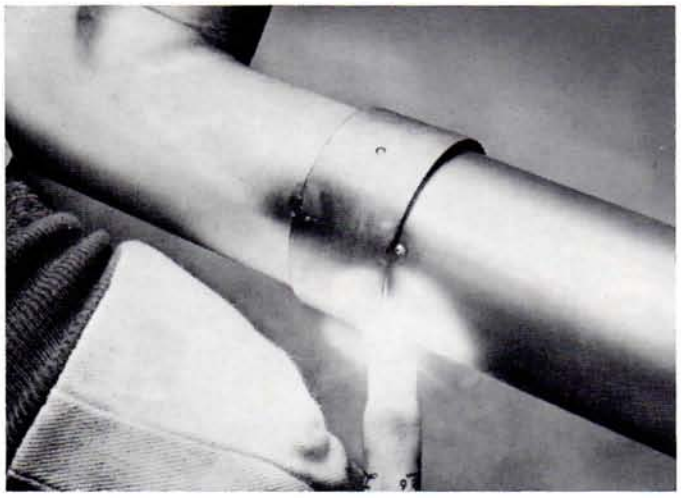
A new standard in process piping economy was established when SPEEDLINE introduced *Tangential* design. The extra straight section on every end of every fitting provides installation advantages that speed and simplify assembly . . . regardless of joining method.

Fitting dimensions, pages 9 to 25.



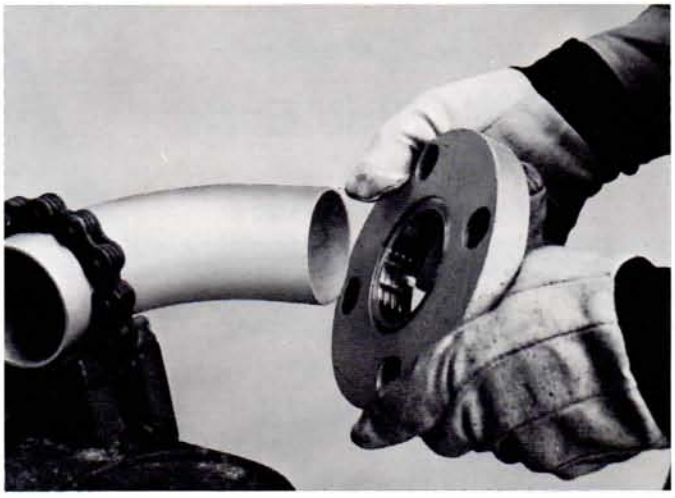
Extra fitting length means welds can be made *straight to straight* . . . away from change in direction. There is plenty of fitting length for use of a simple holding clamp that will insure positive alignment; also speed assembly.

Welding data, pages 64 to 68.



SPEEDLINE extra length facilitates make up of socket joints, too, with use of Aligning Connectors that permit cost saving *in place* pre-assembly. Alignment and fit-up can be accomplished faster and welding is easier, even in difficult locations.

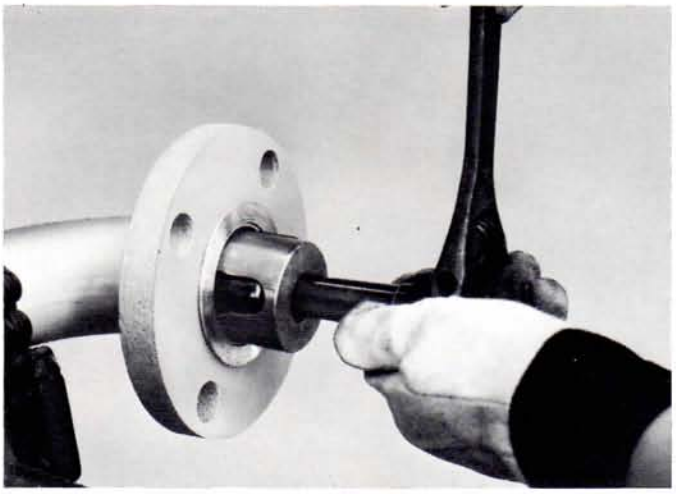
Aligning Connector data, pages 24-25.



SPEEDLINE design adds flanging advantages not possible with conventional fittings. Extra fitting length allows plenty of room to add T/D Insert Flanges to any end of any SPEEDLINE Fitting by expanding (rolling) method or by welding.

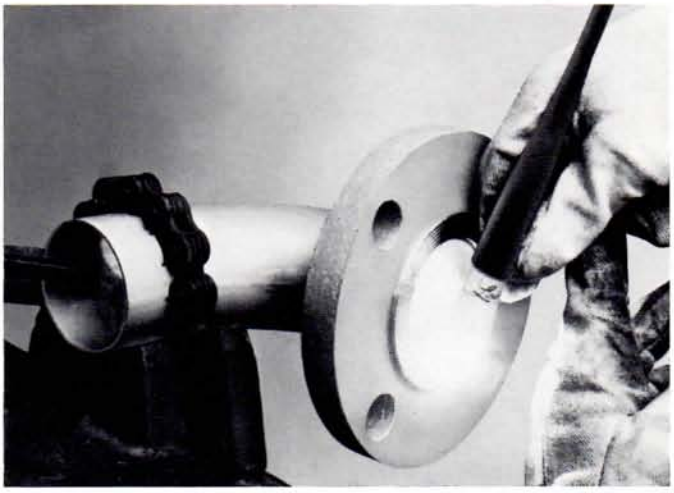
T/D Insert Flange data, page 29.

Speedline® TANGENTIAL DESIGN PROVIDES FITTING LENGTH SUITABLE FOR USE WITH MANY TYPES OF DEMOUNTABLE JOINTS.



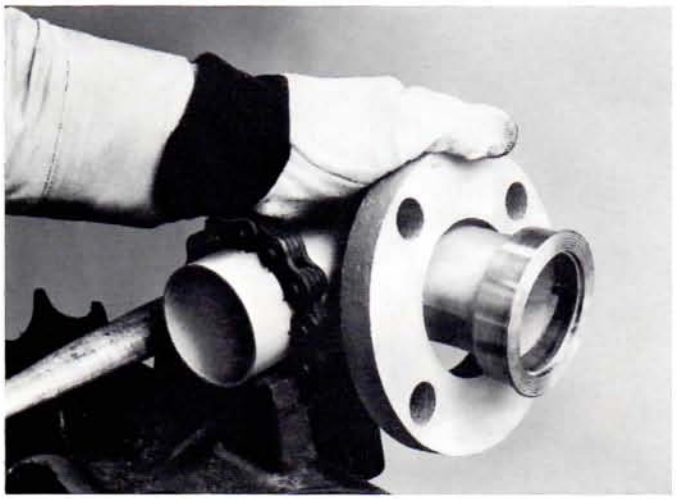
Assembly of patented T/D Insert Flanges does not require special clamps, nor is a welder or welding equipment needed. Leak-proof performance is assured by simply expanding (rolling) fittings or pipe into serrations on ID of flange insert.

Expanding data, pages 35 to 38.



If welding flanges are required, T/D Insert Flanges can replace more costly welding neck, slip-on or socket welding flanges. Fillet welds at back and/or front of the flange will not interfere with free rotation of flange for alignment of bolt holes.

Welding data, pages 64 to 68.

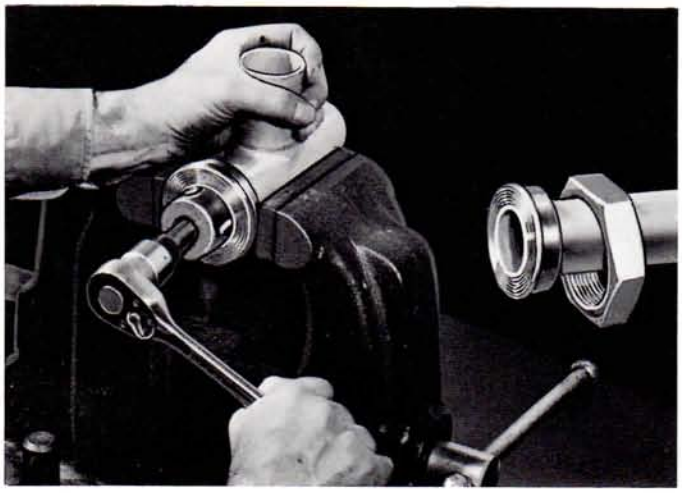


Expanded on or welded on, it is a simple matter to free the T/D Flange from the insert. Then the flange can be rotated to align bolt holes. Provides all the assembly advantages of MSS stub ends and back-up flanges but at a lower cost.

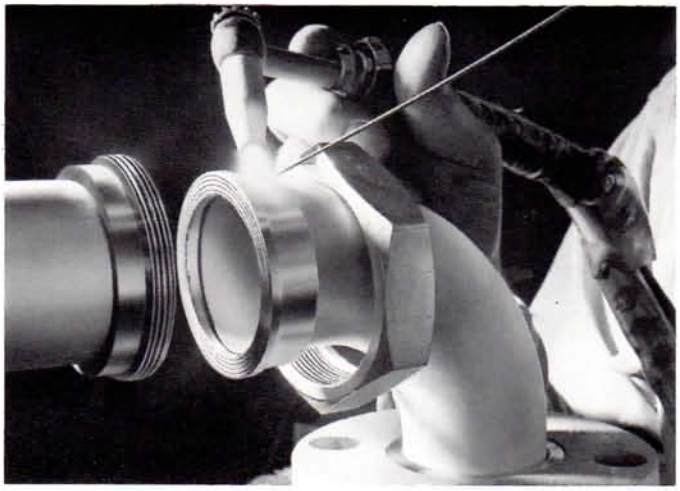
SPEEDLINE Type C Stub Ends are more economical to use than either MSS Type A and B or ASA stub ends. Specially designed SPEEDLINE forming equipment ensures quality stub ends with minimum inside corner radius and carefully controlled lap thickness.

Stub End data, page 22.
Back-up Flange data, page 33.

Speedline® FITTINGS CAN BE BUTT-WELDED, FLANGED, SOCKET JOINED, GROOVED OR USED WITH UNIONS. SEPARATE INVENTORIES CAN BE ELIMINATED.



SPEEDLINE Union design eliminates troublesome ground joints. It is *gasket seated* and *bi-metallic* to eliminate leakage . . . and to permit easier make-up and disassembly, without galling or seizing. Unions are available in three styles . . . for socket welding, butt welding or expanding.



The SPEEDLINE Union provides a fitting that is economical as well as lighter in weight than flanged joints. A union also requires much less room and can be more quickly disconnected for cleaning or inspections.

Union data, page 26.

SPEEDLINE Belled End Fittings are also available to provide an economical socket type fitting designed for joining by welding or brazing. Square cut pipe readily fits into carefully sized sockets to speed alignment and assembly procedures.

Belled End Fitting data, pages 39 to 43.

Whenever a process requires jacketed piping, evaluate the advantages that can be gained with T/D Jacketed piping Insert Flanges. This unique component can be used to increase efficiency of the system and to insure easier installation.

Jacketed Piping data, pages 44 to 63.

Speedline® A PROCESS PIPING SYSTEM THAT IS READILY ADAPTABLE TO ALL DESIGN REQUIREMENTS AND ASSEMBLY METHODS

DIMENSIONED FOR MACHINE WELDING

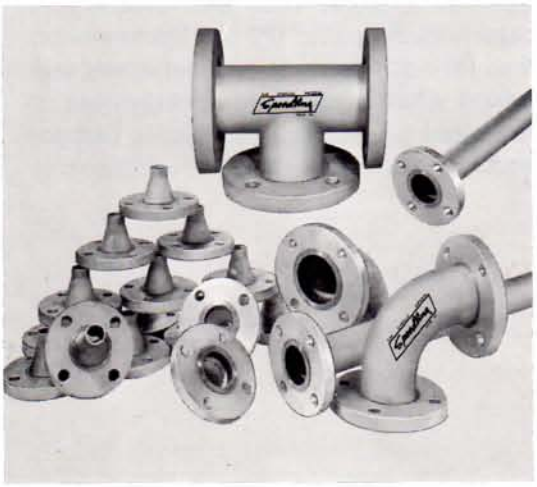
SPEEDLINE extra fitting length provides important advantages when automated welding equipment is employed at the job site.

Ample clearances expedite set-up and facilitate operation to insure maximum production per unit.

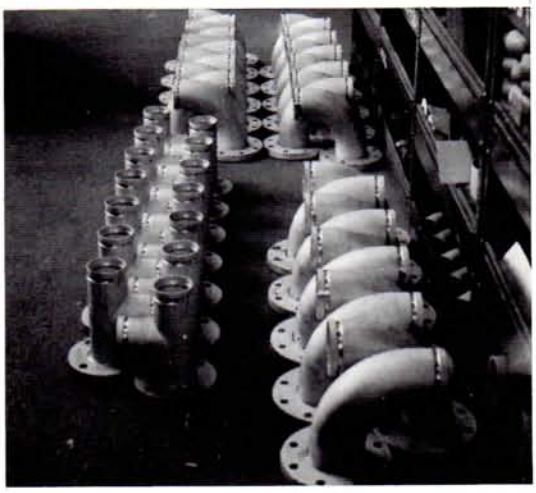
GROOVED END FITTINGS

When mechanical couplings are specified SPEEDLINE Fittings can be grooved on the job or supplied already grooved.

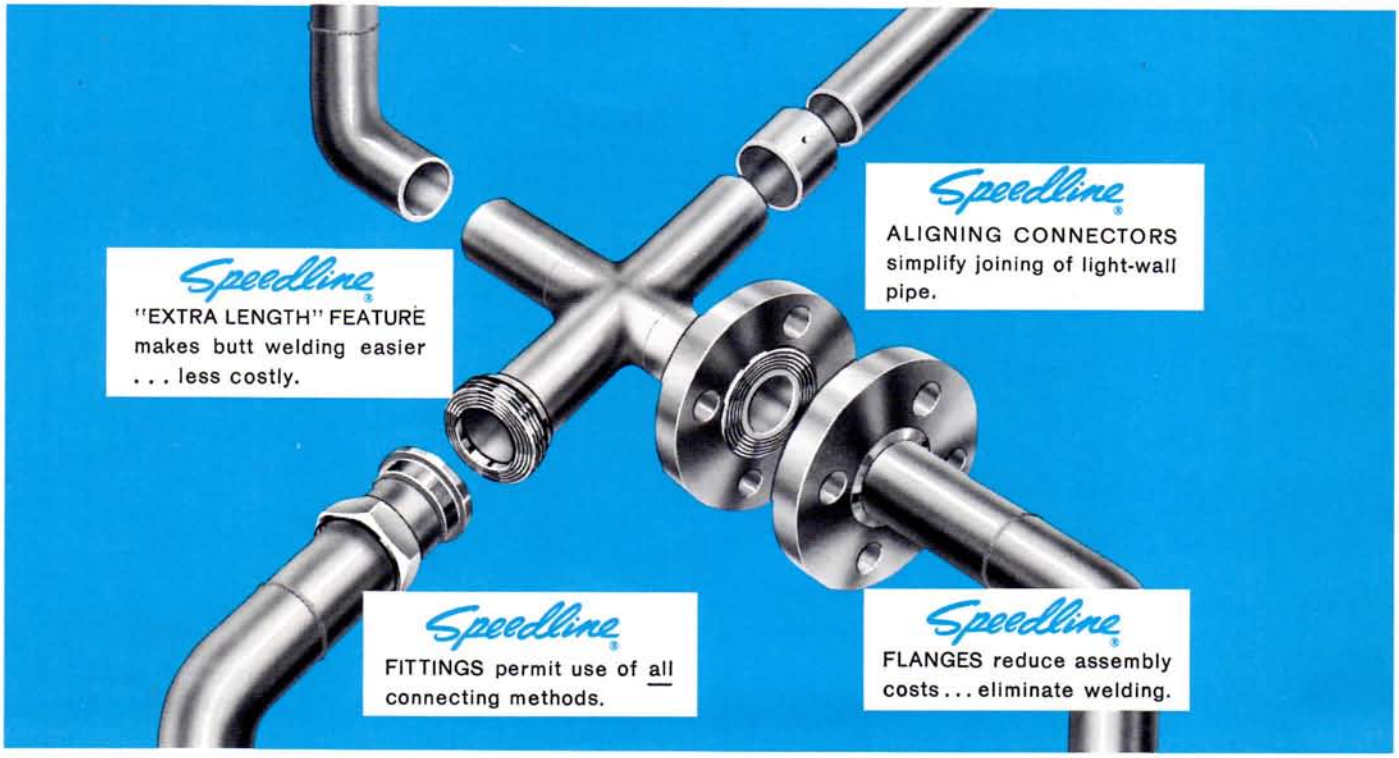
The extra tangent length common to all SPEEDLINE Fittings makes it possible to utilize *any* connecting method. Inventories of special types of fittings can be reduced or eliminated.



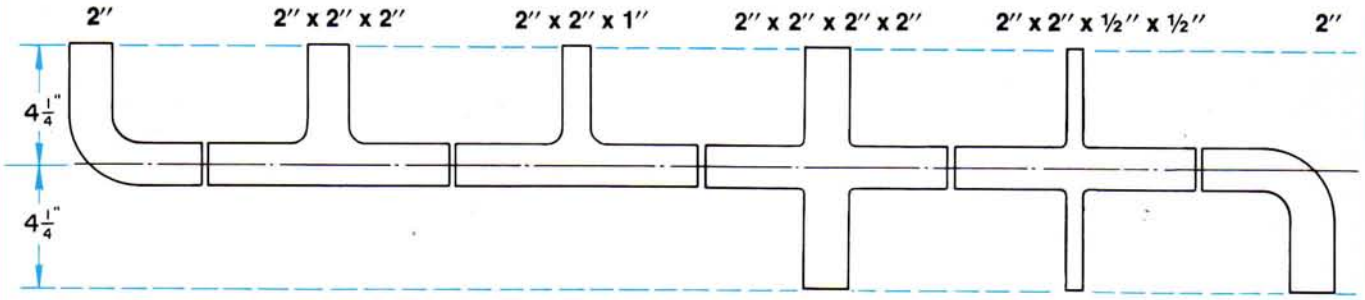
To expedite assembly at the job site SPEEDLINE Fittings may be ordered with Insert Flanges assembled on all or specified ends. Illustrated at right is a customer order calling for Insert Flanges on one end of fitting. Grooving was specified for the other end.

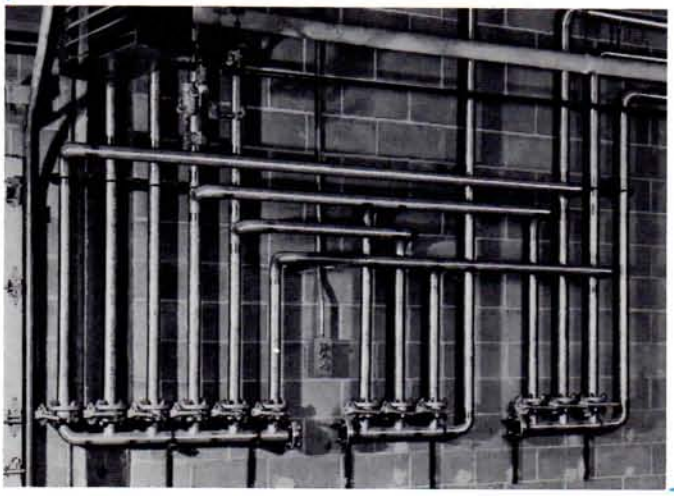


Speedline® DESIGN VERSATILITY CAN SIMPLIFY ASSEMBLY OF COMPLEX PROCESS PIPING



DESIGNED FOR BETTER MANIFOLDING





Speedline Tangential Elbows, Tees and Crosses in sizes through and including 2½" IPS are dimensioned so that ends of all fittings line up to present a neat and orderly appearance when a manifold arrangement is required. Valves, sight gauges, or other piping components can be readily aligned without costly additions or adjustments.

There is a difference in pipe fittings.

THESE Speedline® FEATURES INSURE QUALITY . . . IMPROVE PERFORMANCE

- Reliability begins with SPEEDLINE exacting raw material specifications.
- Rigid in-process production controls and critical inspection standards maintain highest quality.
- Modern production equipment and patented forming methods assure dependable performance.
- Uniform wall thickness at the Bend—in accordance with Specification MSS-SP-43.
- Every stainless steel fitting annealed and pickled.
- Every fitting marked with Size, Analysis, Schedule and Production Code.
- Certified chemical analysis available on request for all fittings.
- Full flange thickness—to ANSI Dimensions plus patented Taper Design advantages.
- Center to end dimensions of SPEEDLINE 90° Elbows, Tees and Crosses are the same for any given size ½" through 2½" IPS, to facilitate manifolding.
- Complete Fitting Line—including Eccentric Reducers, Crosses, Reducing Tees, Laterals, etc.
- Complete selection of metals—Stainless Steel, Monel, Nickel, Alloy 20Cb-3. Other alloys on application.
- Extensive distributor stocks and plant reserve stocks assure availability.

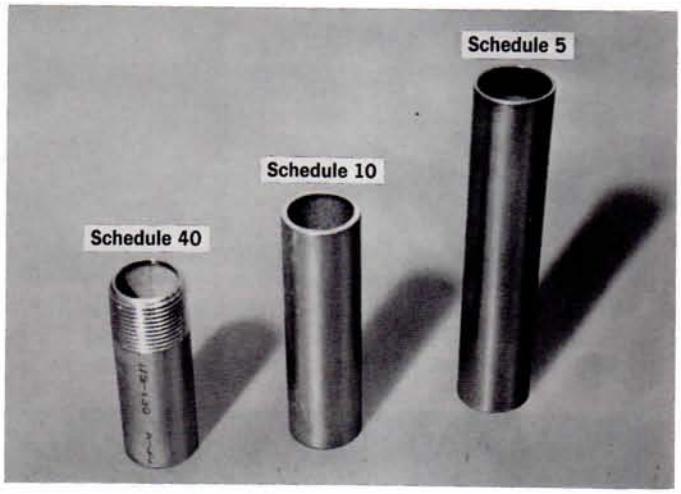
Uniform wall thickness at the Bend in accordance with Specification MSS-SP-43 is assured by SPEEDLINE patented cold-forming process.

SPEEDLINE Fittings are clearly marked with Size, Analysis, Schedule and Production Code.

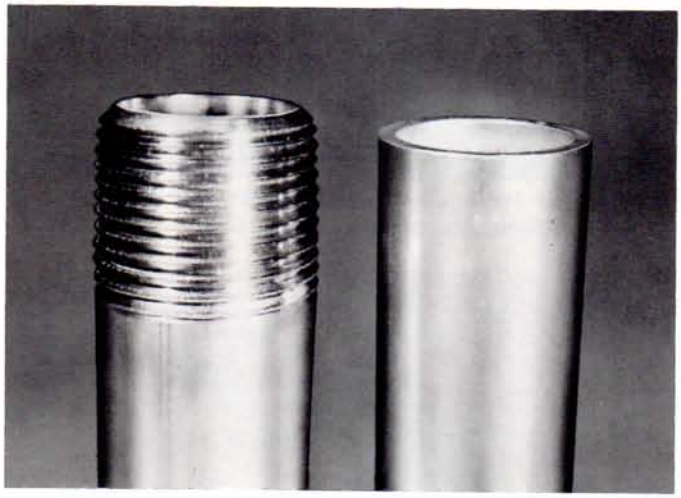
Patented SPEEDLINE T/D (Taper Design) Insert Flange speeds assembly.

Speedline® TANGENTIAL FITTINGS MAKE IT EASIER TO REALIZE ALL OF THE COST SAVING ADVANTAGES OF LIGHT-WALL PROCESS PIPING.

Use of light wall Schedule 5 and 10 Pipe and SPEEDLINE Fittings, instead of Schedule 40, can reduce installed costs as much as 50%.



Each length of pipe shown above costs the same; the difference is in the wall thickness. The lighter the wall, the more pipe footage for your money. And light wall pipe provides a more than adequate factor of safety for most low pressure process lines.



With Schedule 40 pipe and screwed fittings, ½ of the wall thickness is lost *at the threads*. SPEEDLINE Fittings and light wall pipe provide the same effective wall thickness at a considerably lower *installed* cost.

PIPE COMPARISON DATA
(INCHES)
STAINLESS STEEL

Pipe Size I.P.S.	O.D.	Wall Thickness/Wt. per Foot (Lbs.)		
		Schedule 5S	Schedule 10S	Schedule 40S
½	.840	.065 .538	.083 .620	.109 .850
¾	1.050	.065 .684	.083 .867	.113 1.130
1	1.315	.065 .868	.109 1.402	.133 1.678
1¼	1.660	.065 1.107	.109 1.800	.140 2.272
1½	1.900	.065 1.274	.109 2.102	.145 2.717
2	2.375	.065 1.604	.109 2.638	.154 3.652
2½	2.875	.083 2.475	.120 3.531	.203 5.793
3	3.500	.083 3.029	.120 4.332	.216 7.575
4	4.500	.083 3.915	.120 5.613	.237 10.790
6	6.625	.109 7.585	.134 9.289	.280 18.974

See - Page 69 For Pressure-Temperature Data
Page 77 For Pipe Span Data

SPECIFY LIGHT WALL PROCESS PIPE AND SPEEDLINE FITTINGS TO OBTAIN THESE BENEFITS:

Lower purchase costs.
Reduced labor costs.
Decreased hanger and support requirements.
More installation versatility.
Fewer fitting items to inventory.
Nearby distributor stocks of SPEEDLINE Fittings.

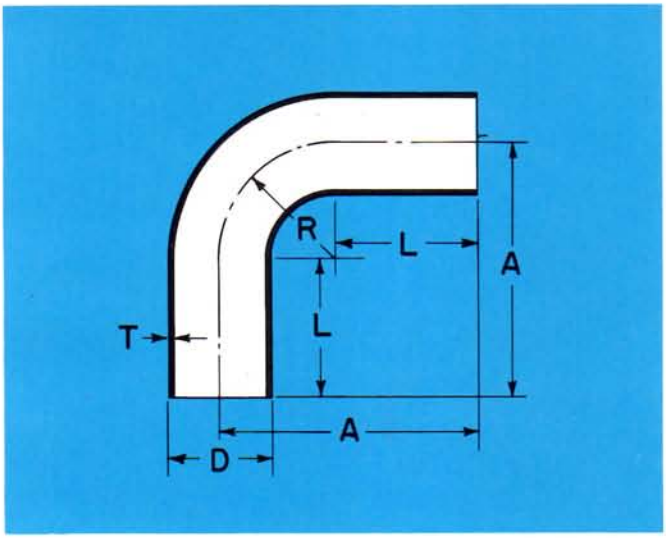
Speedline®

90° ELBOW

Long Radius • Tangential Design

STAINLESS STEELS
Types: 304L, 316L, Alloy 20Cb-3
NICKEL 200, **MONEL** 400

Other alloys on application.



For Speedline Belled End Fittings—see page 39.

The extra length of the 90° Elbow on both ends of the bend permits butt welding, socket welding, flanging or union connection. This versatility is a feature of the entire line of Speedline Fittings.

Pipe Size I.P.S.	O.D. D	Radius R	Tangent L	Center to End A	Sch. 5S Wall T	Sch. 10S Wall T
½	.840	1½	⅞	2⅜	.065	.083
¾	1.050	1⅛	1½	2⅝	.065	.083
1	1.315	1½	1⅜	2⅞	.065	.109
1¼	1.660	1⅞	1¼	3⅛	.065	.109
1½	1.900	2¼	1¼	3½	.065	.109
2	2.375	3	1¼	4¼	.065	.109
2½	2.875	3¾	1¼	5	.083	.120
3	3.500	4½	2	6½	.083	.120
4	4.500	6	2¼	8¼	.083	.120
6	6.625	9	2¼	11¼	.109	.134

Sch. 40S on application.

All dimensions are in inches. See page 105 for dimensional tolerances.

Pipe schedules 5S, 10S, 40S, are in accordance with ANSI B36.19.

All SPEEDLINE fittings are permanently marked by electro-chemical etch that includes SPEEDLINE trademark, type of metal, pipe size, schedule and manufacturing code in accordance with MSS SP-43 and ANSI B16.9.

Bend radii are 1.5 x nominal pipe size except ½" size which is a 3 x nominal pipe size.

Weights of fittings are shown on page 108.

SPEEDLINE fittings are supplied with ends cut square to maintain installation versatility features as described on pages 2 to 6. When required, SPEEDLINE fittings can be supplied beveled in accordance with MSS SP-43.

Wall thickness will not be less than 87½% of nominal pipe wall in accordance with MSS SP-43.

Stainless Steel fittings are supplied fully annealed and pickled. Other metals are heat treated as required by accepted practice and are adequately cleaned to insure maximum corrosion resistance.

Smooth pickle finish, free of surface imperfections, is easy to polish when high lustre is required for appearance.

Speedline®

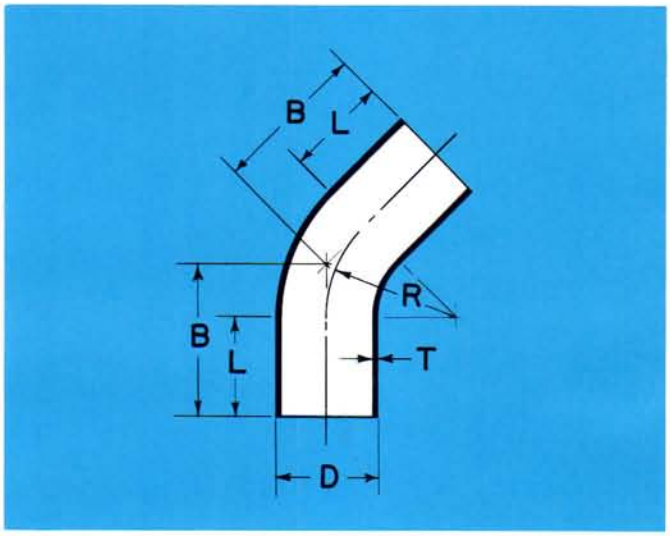
45° ELBOW

Long Radius • Tangential Design

STAINLESS STEELS
Types: 304L, 316L, Alloy 20Cb-3

NICKEL 200, **MONEL** 400

Other alloys on application.



For Speedline Belled End Fittings—see page 39.

Speedline Tangential designs makes it easier and less expensive to use the particular installation procedure best suited to the application. It's the only design that can be butt welded or readily utilized for other joining methods.

Pipe Size I.P.S.	O.D. D	Radius R	Tangent L	Center to End B	Sch 5S Wall T	Sch 10S Wall T
½	.840	1½	⅞	1½	.065	.083
¾	1.050	1⅛	1½	1 15/16	.065	.083
1	1.315	1½	1⅜	2	.065	.109
1¼	1.660	1⅞	1¼	2	.065	.109
1½	1.900	2¼	1¼	2 3/16	.065	.109
2	2.375	3	1¼	2½	.065	.109
2½	2.875	3¾	1¼	2 13/16	.083	.120
3	3.500	4½	2	3⅞	.083	.120
4	4.500	6	2¼	4¾	.083	.120
6	6.625	9	2¼	6	.109	.134

Sch. 40S on application.

All dimensions are in inches. See page 105 for dimensional tolerances.

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Smooth pickle finish, free of surface imperfections, is easy to polish when high lustre is required for appearance.

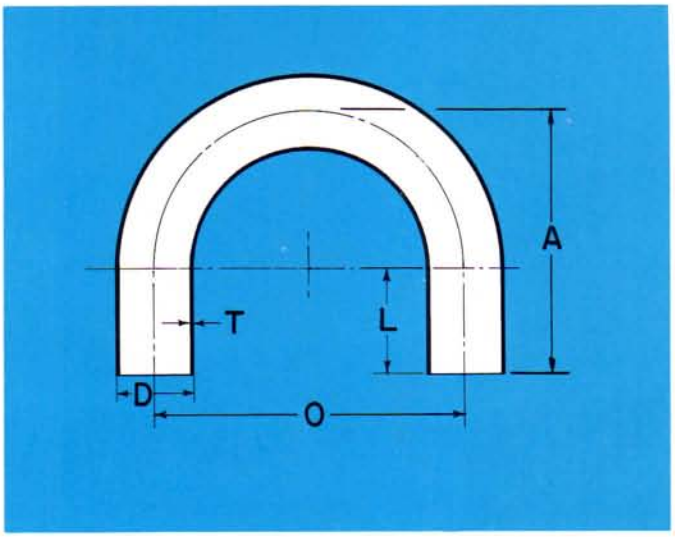
Speedline®

180° RETURN BEND
Tangential Design

STAINLESS STEELS
Types: 304L, 316L, Alloy 20Cb-3

NICKEL 200, **MONEL** 400

Other alloys on application.



For Speedline Belled End Fittings—see page 39.

Increased center to center dimension provides sufficient clearance for addition of flanges to both ends, without fouling.

Center to center dimensions of 3", 4" and 6" sizes are the same as non-tangential long radius welding return bends and therefore are interchangeable.

Pipe Size I. P. S.	O. D. D	Center to Center O	Center to End A	Tangent L	Sch 5S Wall T	Sch 10S Wall T
½	.840	3 5/8	2 3/8	7/8	.065	.083
¾	1.050	4	2 5/8	1 ½	.065	.083
1	1.315	5	2 7/8	1 3/8	.065	.109
1 ¼	1.660	5 ½	3 1/8	1 ¼	.065	.109
1 ½	1.900	6	3 ½	1 ¼	.065	.109
2	2.375	8	5 ½	1 ¼	.065	.109
2 ½	2.875	9	5	1 ¼	.083	.120
3	3.500	9	6 ½	2	.083	.120
4	4.500	12	8 ¼	2 ¼	.083	.120
6	6.625	18	11 ¼	2 ¼	.109	.134

Sch. 40S on application.

All dimensions are in inches. See page 105 for dimensional tolerances.

Pipe schedules 5S, 10S, 40S, are in accordance with ANSI B36.19.

Weights of fittings are shown on page 108.

SPEEDLINE fittings are supplied with ends cut square to maintain installation versatility features as described on pages 2 to 6. When required, SPEEDLINE fittings can be supplied beveled in accordance with MSS SP-43.

Wall thickness will not be less than 87½% of nominal pipe wall in accordance with MSS SP-43.

Stainless Steel fittings are supplied fully annealed and pickled. Other metals are heat treated as required by accepted practice and are adequately cleaned to insure maximum corrosion resistance.

All SPEEDLINE fittings are permanently marked by electro-chemical etch that includes SPEEDLINE trademark, type of metal, pipe size, schedule and manufacturing code in accordance with MSS SP-43 and ANSI B16.9.

Smooth pickle finish, free of surface imperfections, is easy to polish when high lustre is required for appearance.

SPEEDLINE return bends are manufactured by welding two SPEEDLINE 90° elbows together

Speedline®

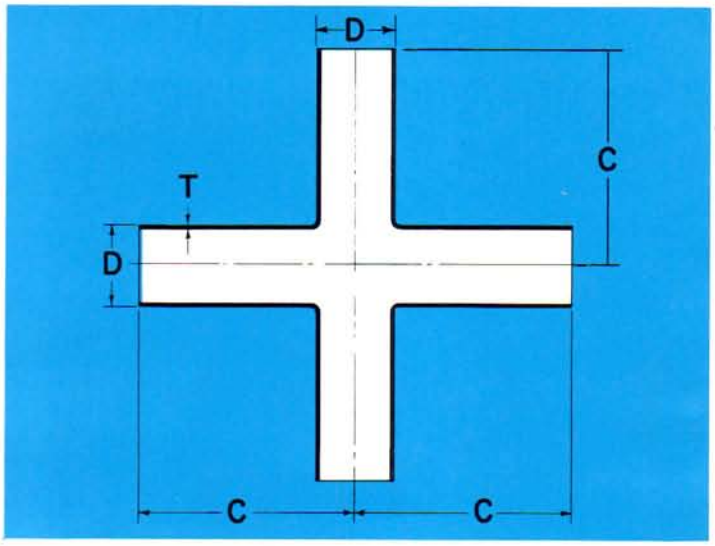
STRAIGHT CROSS

Tangential Design

STAINLESS STEELS
Types: 304L, 316L, Alloy 20Cb-3

NICKEL 200, **MONEL** 400

Other alloys on application.



For Speedline Belled End Fittings—see page 39.

Tangential design permits flanging without fouling or selection of any other joining method or combination of methods.

Crosses, Straight Tees and Reducing Outlet Tees with longer side outlets (up to 16" long, annealed), are available on special order.

Pipe Size I. P. S.	O. D. D	Center to End C	Sch 5S Wall T	Sch 10S Wall T
½	.840	2 3/8	.065	.083
¾	1.050	2 5/8	.065	.083
1	1.315	2 7/8	.065	.109
1 1/4	1.660	3 1/8	.065	.109
1 1/2	1.900	3 1/2	.065	.109
2	2.375	4 1/4	.065	.109
2 1/2	2.875	5	.083	.120
3	3.500	5	.083	.120
4	4.500	5 3/4	.083	.120
6	6.625	7 7/8	.109	.134

Sch. 40S on application.

Reducing crosses also available—see reducing outlet tees page 14 for outlet dimensional data.

All dimensions are in inches. See page 105 for dimensional tolerances.

Pipe schedules 5S, 10S, 40S, are in accordance with ANSI B36.19.

SPEEDLINE fittings are supplied with ends cut square to maintain installation versatility features as described on pages 2 to 6. When required, SPEEDLINE fittings can be supplied beveled in accordance with MSS SP-43.

All SPEEDLINE fittings are permanently marked by electro-chemical etch that includes SPEEDLINE trademark, type of metal, pipe size, schedule and manufacturing code in accordance with MSS SP-43 and ANSI B16.9.

Stainless Steel fittings are supplied fully annealed and pickled. Other metals are heat treated as required by accepted practice and are adequately cleaned to insure maximum corrosion resistance.

Weights of fittings are shown on page 108.

Smooth pickle finish, free of surface imperfections, is easy to polish when high lustre is required for appearance.

Speedline®

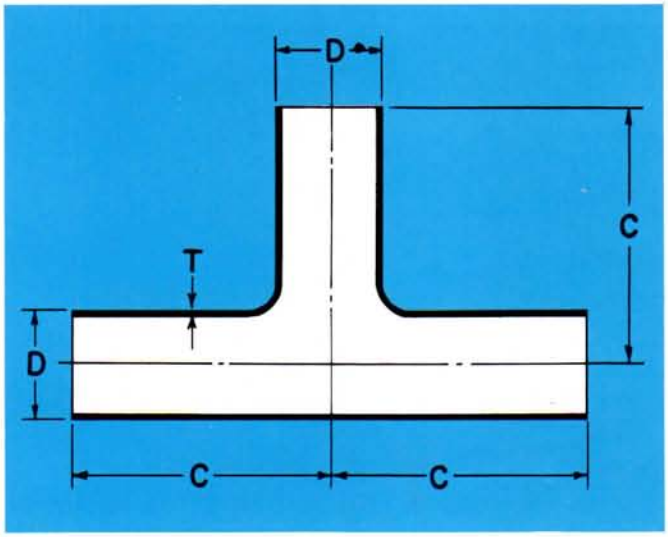
STRAIGHT TEES

Tangential Design

STAINLESS STEELS
Types: 304L, 316L, Alloy 20Cb-3

NICKEL 200, **MONEL** 400

Other alloys on application.



For Speedline Belled End Fittings—see page 39.

Tangential design provides the extra length that is particularly useful when flanges or other fittings are to be attached to one or more ports of the tee.

Straight Tees, Reducing Outlet Tees and Crosses, with longer side outlets (up to 16" long, annealed) are available on special order.

Pipe Size I.P.S.	O.D. D	Center to End C	Sch 5S Wall T	Sch 10S Wall T
½	.840	2 3/8	.065	.083
¾	1.050	2 5/8	.065	.083
1	1.315	2 7/8	.065	.109
1 ¼	1.660	3 1/8	.065	.109
1 ½	1.900	3 ½	.065	.109
2	2.375	4 ¼	.065	.109
2 ½	2.875	5	.083	.120
3	3.500	5	.083	.120
4	4.500	5 ¾	.083	.120
6	6.625	7 7/8	.109	.134

Sch. 40S on application.

All dimensions are in inches. See page 105 for dimensional tolerances.

Pipe schedules 5S, 10S, 40S, are in accordance with ANSI B36.19.

SPEEDLINE fittings are supplied with ends cut square to maintain installation versatility features as described on pages 2 to 6. When required, SPEEDLINE fittings can be supplied beveled in accordance with MSS SP-43.

All SPEEDLINE fittings are permanently marked by electro-chemical etch that includes SPEEDLINE trademark, type of metal, pipe size, schedule and manufacturing code in accordance with MSS SP-43 and ANSI B16.9.

Stainless Steel fittings are supplied fully annealed and pickled. Other metals are heat treated as required by accepted practice and are adequately cleaned to insure maximum corrosion resistance.

Weights of fittings are shown on page 108.

Smooth pickle finish, free of surface imperfections, is easy to polish when high lustre is required for appearance.

Speedline®

REDUCING OUTLET TEES

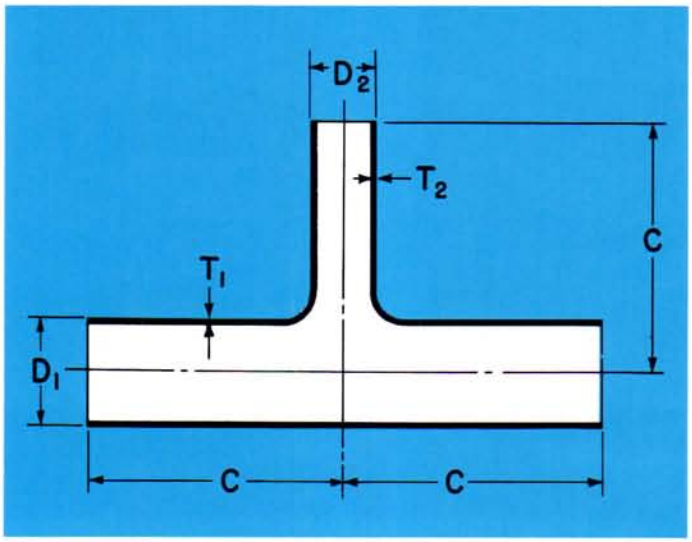
Tangential Design

STAINLESS STEELS
Types: 304L, 316L, Alloy 20Cb-3

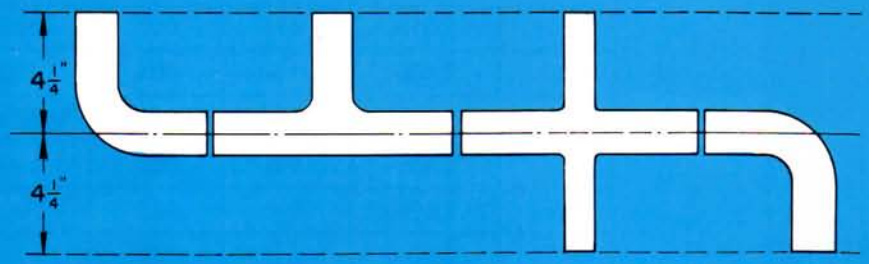
NICKEL 200, **MONEL** 400

Other alloys on application.

Reducing Outlet Tees, Straight Tees and Crosses, with longer side outlets (up to 16" long, annealed) are available on special order.



Tees with side outlet larger than run (bull nose tee) can be furnished on special order. Center to end dimension of side outlet will be longer than for Reducing Outlet Tees.



For Speedline Belled End Fittings—see page 39.

The center to end dimension of all Speedline Reducing Outlet Tees is the same as the Straight Tee of run size. This advantage simplifies manifolding layout for the piping design engineer.

All dimensions are in inches. See page 105 for dimensional tolerances.

Pipe schedules 5S, 10S, 40S, are in accordance with ANSI B36.19.

SPEEDLINE fittings are supplied with ends cut square to maintain installation versatility features as described on pages 2 to 6. When required, SPEEDLINE fittings can be supplied beveled in accordance with MSS SP-43.

All SPEEDLINE fittings are permanently marked by electro-chemical etch that includes SPEEDLINE trademark, type of metal, pipe size, schedule and manufacturing code in accordance with MSS SP-43 and ANSI B16.9.

Stainless Steel fittings are supplied fully annealed and pickled. Other metals are heat treated as required by accepted practice and are adequately cleaned to insure maximum corrosion resistance.

Weights of fittings are shown on page 108.

Smooth pickle finish, free of surface imperfections, is easy to polish when high lustre is required for appearance.

REDUCING OUTLET TEES

Pipe Size I.P.S. Run	Outlet	O.D. D_1 Run	D_2 Outlet	Center to End C	Sch 5S Wall T_1 Run	T_2 Outlet	Sch 10S Wall T_1 Run	T_2 Outlet
¾	½	1.050	.840	2 5/8	.065	.065	.083	.083
1	½	1.315	.840	2 7/8	.065	.065	.109	.083
	¾	1.315	1.050	2 7/8	.065	.065	.109	.083
1¼	½	1.660	.840	3 1/8	.065	.065	.109	.083
	¾	1.660	1.050	3 1/8	.065	.065	.109	.083
	1	1.660	1.315	3 1/8	.065	.065	.109	.109
1½	½	1.900	.840	3 ½	.065	.065	.109	.083
	¾	1.900	1.050	3 ½	.065	.065	.109	.083
	1	1.900	1.315	3 ½	.065	.065	.109	.109
	1¼	1.900	1.660	3 ½	.065	.065	.109	.109
2	½	2.375	.840	4 ¼	.065	.065	.109	.083
	¾	2.375	1.050	4 ¼	.065	.065	.109	.083
	1	2.375	1.315	4 ¼	.065	.065	.109	.109
	1¼	2.375	1.660	4 ¼	.065	.065	.109	.109
	1½	2.375	1.900	4 ¼	.065	.065	.109	.109
2½	½	2.875	.840	5	.083	.065	.120	.083
	¾	2.875	1.050	5	.083	.065	.120	.083
	1	2.875	1.315	5	.083	.065	.120	.109
	1¼	2.875	1.660	5	.083	.065	.120	.109
	1½	2.875	1.900	5	.083	.065	.120	.109
	2	2.875	2.375	5	.083	.065	.120	.109
3	½	3.500	.840	5	.083	.065	.120	.083
	¾	3.500	1.050	5	.083	.065	.120	.083
	1	3.500	1.315	5	.083	.065	.120	.109
	1¼	3.500	1.660	5	.083	.065	.120	.109
	1½	3.500	1.900	5	.083	.065	.120	.109
	2	3.500	2.375	5	.083	.065	.120	.109
	2½	3.500	2.875	5	.083	.083	.120	.120
4	½	4.500	.840	5 ¾	.083	.065	.120	.083
	¾	4.500	1.050	5 ¾	.083	.065	.120	.083
	1	4.500	1.315	5 ¾	.083	.065	.120	.109
	1¼	4.500	1.660	5 ¾	.083	.065	.120	.109
	1½	4.500	1.900	5 ¾	.083	.065	.120	.109
	2	4.500	2.375	5 ¾	.083	.065	.120	.109
	2½	4.500	2.875	5 ¾	.083	.083	.120	.120
	3	4.500	3.500	5 ¾	.083	.083	.120	.120
6	½	6.625	.840	7 7/8	.109	.065	.134	.083
	¾	6.625	1.050	7 7/8	.109	.065	.134	.083
	1	6.625	1.315	7 7/8	.109	.065	.134	.109
	1¼	6.625	1.660	7 7/8	.109	.065	.134	.109
	1½	6.625	1.900	7 7/8	.109	.065	.134	.109
	2	6.625	2.375	7 7/8	.109	.065	.134	.109
	2½	6.625	2.875	7 7/8	.109	.083	.134	.120
	3	6.625	3.500	7 7/8	.109	.083	.134	.120
	4	6.625	4.500	7 7/8	.109	.083	.134	.120

Sch. 40S on application.

Speedline®

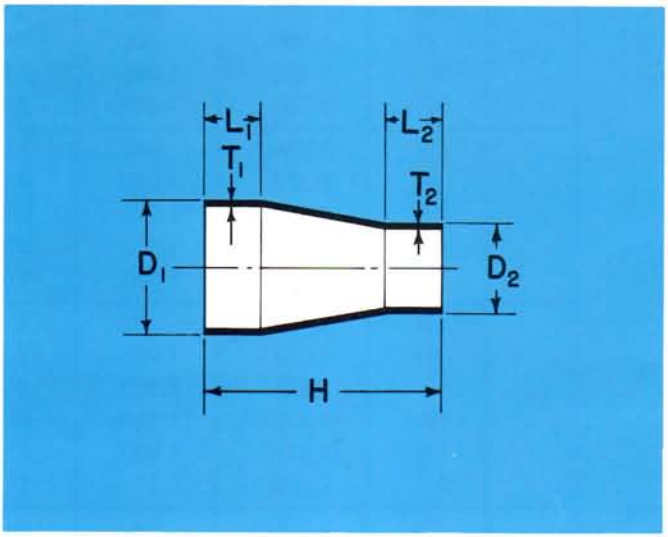
CONCENTRIC REDUCERS

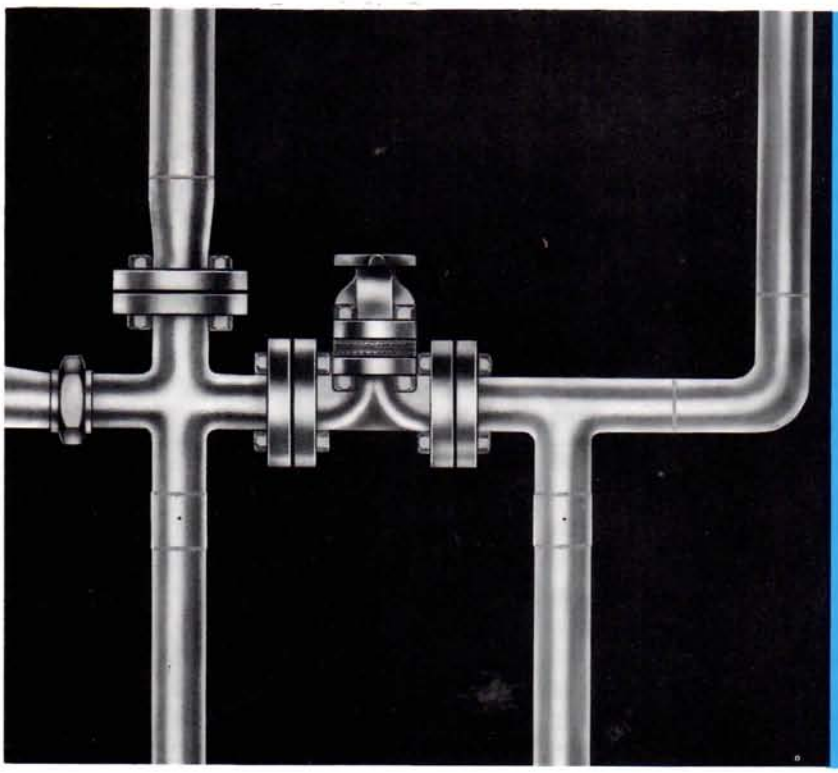
Tangential Design

STAINLESS STEELS
Types: 304L, 316L, Alloy 20Cb-3

NICKEL 200, **MONEL** 400

Other alloys on application.





For Speedline Belled End Fittings—see page 39.

Speedline design makes it easier to butt weld reducers and they can also be flanged or socket welded with equal ease because tangential design adds maximum versatility to every Speedline fitting.

CONCENTRIC REDUCERS

Pipe Size I.P.S. Large End	Pipe Size I.P.S. Small End	O.D. D_1 Large End	O.D. D_2 Small End	Length H	Tangent Length (minimum) L_1 Large End	Tangent Length (minimum) L_2 Small End	Sch 5S Wall T_1 Large End	Sch 5S Wall T_2 Small End	Sch 10S Wall T_1 Large End	Sch 10S Wall T_2 Small End
¾	½	1.050	.840	3¾	⅞	⅞	.065	.065	.083	.083
1	½	1.315	.840	3¾	⅞	⅞	.065	.065	.109	.083
	¾	1.315	1.050	3¾	⅞	⅞	.065	.065	.109	.083
1¼	¾	1.660	1.050	3¾	⅞	⅞	.065	.065	.109	.083
	1	1.660	1.315	3¾	⅞	⅞	.065	.065	.109	.109
1½	½	1.900	.840	3¾	⅞	⅞	.065	.065	.109	.083
	¾	1.900	1.050	3¾	⅞	⅞	.065	.065	.109	.083
	1	1.900	1.315	3¾	⅞	⅞	.065	.065	.109	.109
	1¼	1.900	1.660	3¾	⅞	⅞	.065	.065	.109	.109
2	½	2.375	.840	3¾	1⅛	⅞	.065	.065	.109	.083
	¾	2.375	1.050	3¾	1⅛	⅞	.065	.065	.109	.083
	1	2.375	1.315	3¾	1⅛	⅞	.065	.065	.109	.109
	1¼	2.375	1.660	3¾	1⅛	⅞	.065	.065	.109	.109
	1½	2.375	1.900	3¾	1⅛	⅞	.065	.065	.109	.109
2½	1	2.875	1.315	5¼	1⅛	⅞	.083	.065	.120	.109
	1¼	2.875	1.660	5¼	1⅛	⅞	.083	.065	.120	.109
	1½	2.875	1.900	5¼	1⅛	⅞	.083	.065	.120	.109
	2	2.875	2.375	5¼	1⅛	1⅛	.083	.065	.120	.109
3	1	3.500	1.315	5¼	1⅛	⅞	.083	.065	.120	.109
	1¼	3.500	1.660	5¼	1⅛	⅞	.083	.065	.120	.109
	1½	3.500	1.900	5¼	1⅛	⅞	.083	.065	.120	.109
	2	3.500	2.375	5¼	1⅛	1⅛	.083	.065	.120	.109
	2½	3.500	2.875	5¼	1⅛	1⅛	.083	.083	.120	.120
4	2	4.500	2.375	5¼	1⅛	1⅛	.083	.065	.120	.109
	2½	4.500	2.875	5¼	1⅛	1⅛	.083	.083	.120	.120
	3	4.500	3.500	5¼	1⅛	1⅛	.083	.083	.120	.120
6	3	6.625	3.500	9	3¾	1½	.109	.083	.134	.120
	4	6.625	4.500	9	3¾	1½	.109	.083	.134	.120

Sch. 40S on application.

All dimensions are in inches. See page 105 for dimensional tolerances.

Pipe schedules 5S, 10S, 40S, are in accordance with ANSI B36.19.

SPEEDLINE fittings are supplied with ends cut square to maintain installation versatility features as described on pages 2 to 6. When required, SPEEDLINE fittings can be supplied beveled in accordance with MSS SP-43.

Weights of fittings are shown on page 108.

Wall thickness will not be less than 87½% of nominal pipe wall in accordance with MSS SP-43.

All SPEEDLINE fittings are permanently marked by electro-chemical etch that includes SPEEDLINE trademark, type of metal, pipe size, schedule and manufacturing code in accordance with MSS SP-43 and ANSI B16.9.

Stainless Steel fittings are supplied fully annealed and pickled. Other metals are heat treated as required by accepted practice and are adequately cleaned to insure maximum corrosion resistance.

Smooth pickle finish, free of surface imperfections, is easy to polish when high lustre is required for appearance.

Speedline®

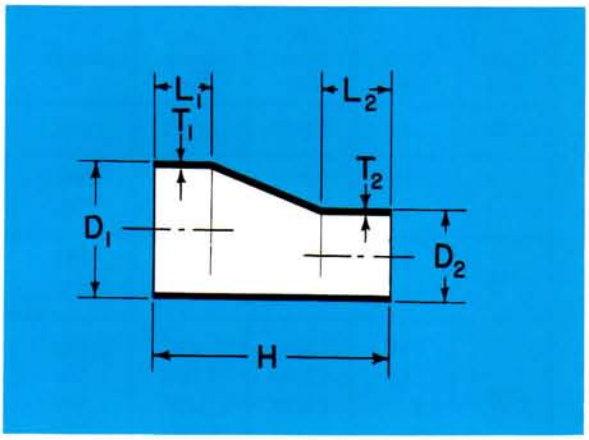
ECCENTRIC REDUCERS

Tangential Design

STAINLESS STEELS
Types: 304L, 316L, Alloy 20Cb-3

NICKEL 200, **MONEL** 400

Other alloys on application.



Pipe Size I.P.S. Large End	Pipe Size I.P.S. Small End	O.D. D_1 Large End	O.D. D_2 Small End	Length H	Tangent Length (minimum) L_1 Large End	Tangent Length (minimum) L_2 Small End	Sch 5S Wall T_1 Large End	Sch 5S Wall T_2 Small End	Sch 10S Wall T_1 Large End	Sch 10S Wall T_2 Small End
¾	½	1.050	.840	3¾	⅞	⅞	.065	.065	.083	.083
1	½	1.315	.840	3¾	⅞	⅞	.065	.065	.109	.083
	¾	1.315	1.050	3¾	⅞	⅞	.065	.065	.109	.083
1¼	1	1.660	1.315	3¾	⅞	⅞	.065	.065	.109	.109
1½	¾	1.900	1.050	3¾	⅞	⅞	.065	.065	.109	.083
	1	1.900	1.315	3¾	⅞	⅞	.065	.065	.109	.109
	1¼	1.900	1.660	3¾	⅞	⅞	.065	.065	.109	.109
2	1	2.375	1.315	3¾	1⅛	⅞	.065	.065	.109	.109
	1¼	2.375	1.660	3¾	1⅛	⅞	.065	.065	.109	.109
	1½	2.375	1.900	3¾	1⅛	⅞	.065	.065	.109	.109
2½	2	2.875	2.375	5¼	1⅛	1⅛	.083	.065	.120	.109
3	2	3.500	2.375	5¼	1⅛	1⅛	.083	.065	.120	.109
	2½	3.500	2.875	5¼	1⅛	1⅛	.083	.083	.120	.120
4	2½	4.500	2.875	5¼	1⅛	1⅛	.083	.083	.120	.120
	3	4.500	3.500	5¼	1⅛	1⅛	.083	.083	.120	.120
6	4	6.625	4.500	9	3½	1¼	.109	.083	.134	.120

For Speedline Belled End Fittings—see page 39.

Sch. 40S on application.

All dimensions are in inches. See page 105 for dimensional tolerances.

Pipe schedules 5S, 10S, 40S, are in accordance with ANSI B36.19.

SPEEDLINE fittings are supplied with ends cut square to maintain installation versatility features as described on pages 2 to 6. When required, SPEEDLINE fittings can be supplied beveled in accordance with MSS SP-43.

Weights of fittings are shown on page 108.

Wall thickness will not be less than 87½% of nominal pipe wall in accordance with MSS SP-43.

All SPEEDLINE fittings are permanently marked by electro-chemical etch that includes SPEEDLINE trademark, type of metal, pipe size, schedule and manufacturing code in accordance with MSS SP-43 and ANSI B16.9.

Stainless Steel fittings are supplied fully annealed and pickled. Other metals are heat treated as required by accepted practice and are adequately cleaned to insure maximum corrosion resistance.

Smooth pickle finish, free of surface imperfections, is easy to polish when high lustre is required for appearance.

Speedline®

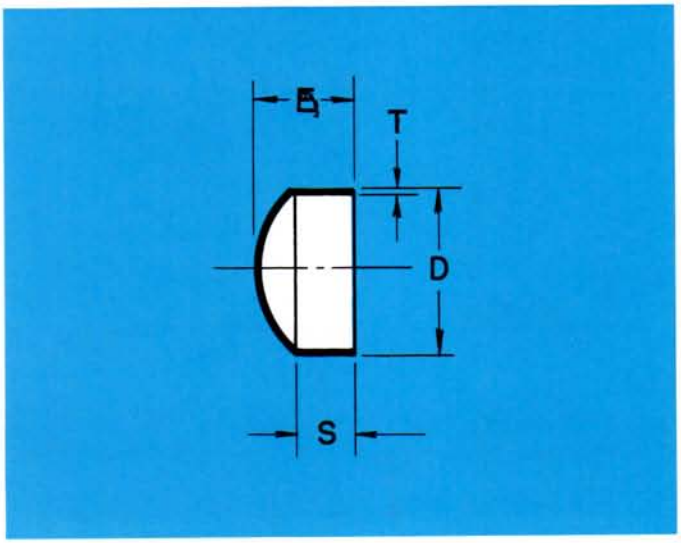
CAP

Tangential Design

STAINLESS STEELS
Types: 304L, 316L, Alloy 20Cb-3

NICKEL 200, **MONEL** 400

Other alloys on application.



In addition to the normal use for closing off ends of pipelines or fittings, many manufacturers use Speedline caps as equipment components.

Pipe Size I.P.S.	O.D. D	Length E	Tangent (approximate) S	Sch 5S Wall T	Sch 10S Wall T
½	.840	½	¼	.065	.083
¾	1.050	¾	½	.065	.083
1	1.315	⅞	½	.065	.109
1¼	1.660	1 1/16	⅝	.065	.109
1½	1.900	1¼	⅝	.065	.109
2	2.375	1 7/16	¾	.065	.109
2½	2.875	1¾	⅞	.083	.120
3	3.500	2	1	.083	.120
4	4.500	2 9/16	1¼	.083	.120
6	6.625	3½	1⅝	.109	.134

All dimensions are in inches. See page 105 for dimensional tolerances.

Pipe schedules 5S, 10S, 40S, are in accordance with ANSI B36.19.

Weights of fittings are shown on page 108.

6" Caps in Schedule 5 and all SPEEDLINE Schedule 10 Caps are beveled in accordance with MSS SP-43.

Wall thickness will not be less than 87½% of nominal pipe wall in accordance with MSS SP-43.

All SPEEDLINE fittings are permanently marked by electro-chemical etch that includes SPEEDLINE trademark, type of metal, pipe size, schedule and manufacturing code in accordance with MSS SP-43 and ANSI B16.9.

Stainless Steel fittings are supplied fully annealed and pickled. Other metals are heat treated as required by accepted practice and are adequately cleaned to insure maximum corrosion resistance.

Smooth pickle finish, free of surface imperfections, is easy to polish when high lustre is required for appearance.

Speedline®

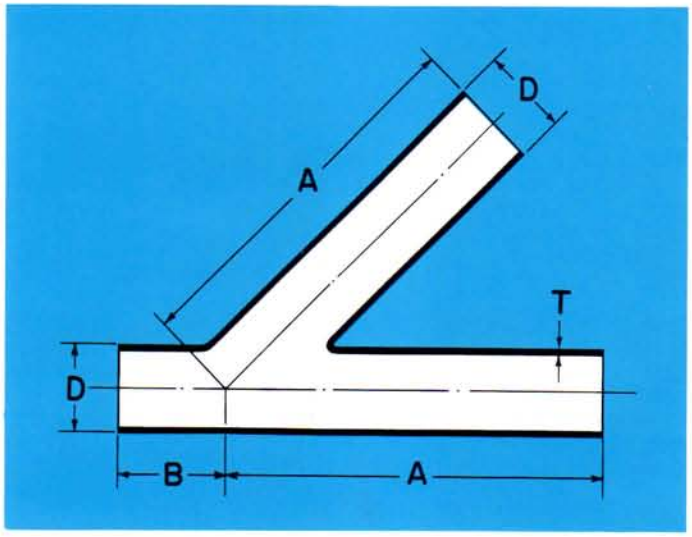
45° LATERALS

Tangential Design

STAINLESS STEELS
Types: 304L, 316L, Alloy 20Cb-3

NICKEL 200, **MONEL** 400

Other alloys on application.



For Speedline Belled End Fittings—see page 39.

Tangential design makes butt welding easier or flanging and other connecting methods possible. Speedline's extra length adds unrestricted assembly versatility to every fitting.

Pipe Size I.P.S.	O.D. D	Center to End		Sch 5S Wall T	Sch 10S Wall T
		A	B		
1	1.315	6	1¾	.065	.109
1¼	1.660	6¾	1¾	.065	.109
1½	1.900	7¼	2	.065	.109
2	2.375	8½	2½	.065	.109
2½	2.875	10	2½	.083	.120
3	3.500	11	3	.083	.120
4	4.500	12½	3	.083	.120
6	6.625	15	3½	.109	.134

Reducing outlet laterals also available on application.

All dimensions are in inches. See page 105 for dimensional tolerances.

Pipe schedules 5S, 10S, 40S, are in accordance with ANSI B36.19.

SPEEDLINE fittings are supplied with ends cut square to maintain installation versatility features as described on pages 2 to 6. When required, SPEEDLINE fittings can be supplied beveled in accordance with MSS SP-43.

Nondestructive testing of shop welds on 45° Laterals is limited to dye penetrant examination.

Weights of fittings are shown on page 108.

All SPEEDLINE fittings are permanently marked by electro-chemical etch that includes SPEEDLINE trademark, type of metal, pipe size, schedule and manufacturing code in accordance with MSS SP-43 and ANSI B16.9.

Wall thickness of run adjacent to outlet weld may be slightly less than MSS SP-43 requirements.

Stainless Steel fittings are supplied fully annealed and pickled. Other metals are heat treated as required by accepted practice and are adequately cleaned to insure maximum corrosion resistance.

Smooth pickle finish, free of surface imperfections, is easy to polish when high lustre is required for appearance.

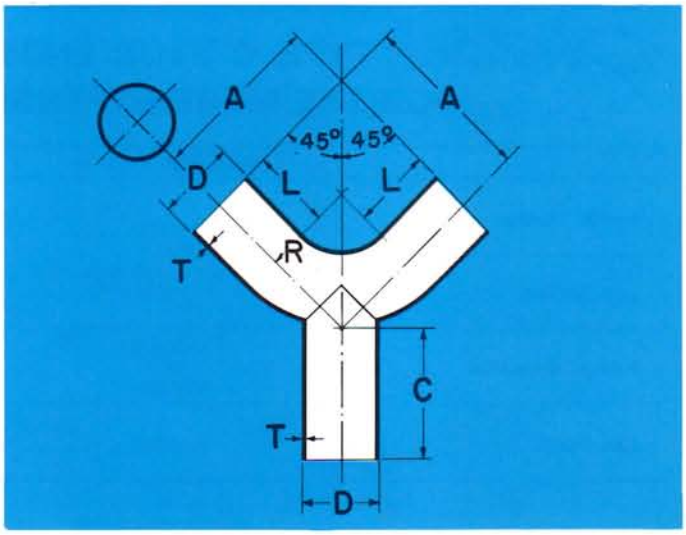
Speedline®

TRUE Y

Tangential Design

STAINLESS STEELS
Types: 304L, 316L, Alloy 20Cb-3
NICKEL 200, **MONEL** 400

Other alloys on application.



For Speedline Belled End Fittings—see page 39.

Butt weld, socket weld; use T/D Insert Flanges or Speedline Unions. Tangential design provides the versatility that can simplify and speed process piping assembly.

Pipe Size I.P.S.	O.D. D	Radius R	Tangent L	Center to End A	Center to End (side outlet) C (nearest 1/16")	Sch 5S Wall T	Sch 10S Wall T
1	1.315	1½	1⅜	2⅞	2¼	.065	.109
1¼	1.660	1⅞	1¼	3⅛	2⅜	.065	.109
1½	1.900	2¼	1¼	3½	2 9/16	.065	.109
2	2.375	3	1¼	4¼	3	.065	.109
2½	2.875	3¾	1¼	5	3 7/16	.083	.120
3	3.500	4½	2	6½	3 3/16	.083	.120
4	4.500	6	2¼	8¼	3¼	.083	.120
6	6.625	9	2¼	11¼	4⅛	.109	.134

Reducing Side Outlet Y Fittings also available on application.

Sch. 40S on application.

All dimensions are in inches. See page 105 for dimensional tolerances.

Pipe schedules 5S, 10S, 40S, are in accordance with ANSI B36.19.

All SPEEDLINE fittings are permanently marked by electro-chemical etch that includes SPEEDLINE trademark, type of metal, pipe size, schedule and manufacturing code in accordance with MSS SP-43 and ANSI B16.9.

Nondestructive testing of shop welds on True Y fittings is limited to dye penetrant examination.

Weights of fittings are shown on page 108.

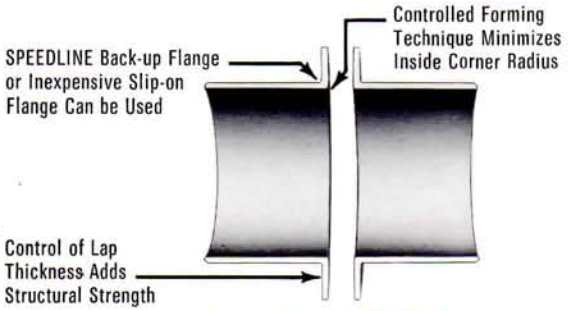
SPEEDLINE fittings are supplied with ends cut square to maintain installation versatility features as described on pages 2 to 6. When required, SPEEDLINE fittings can be supplied beveled in accordance with MSS SP-43.

Wall thickness will not be less than 87½% of nominal pipe wall in accordance with MSS SP-43.

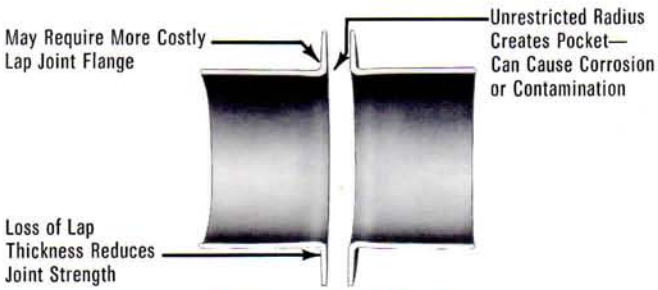
Stainless Steel fittings are supplied fully annealed and pickled. Other metals are heat treated as required by accepted practice and are adequately cleaned to insure maximum corrosion resistance.

Smooth pickle finish, free of surface imperfections, is easy to polish when high lustre is required for appearance.

Speedline TYPE C STUB ENDS ARE QUALITY ENGINEERED TO MEET EXACTING PROCESS PIPING STANDARDS

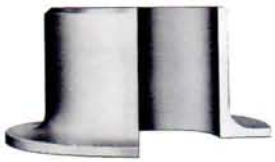


Speedline Stub Ends Meet High Quality Standards



Ordinary Stub Ends Often Lack Important Advantages

Speedline TYPE C STUB ENDS ARE THE ECONOMICAL ALTERNATE FOR THE MORE EXPENSIVE TYPE A AND B DESIGNS

	Speedline Type C	Type A	Type B
Inside Corner	Radius (Max.) 1/32"-1/2" thru 4" sizes 1/16"-5" thru 6" sizes	Square	Square
Lap Radius		MSS or ANSI (ASA) Std. Radius	Square (1/32" Max. Radius)
Flange Required	Back-Up or Slip-On	Lap Joint	Back-Up or Slip-On
Lap Face	Smooth	Serrated	Serrated
Cutaway Views Illustrate Design Differences			

Speedline TYPE C STUB ENDS COMBINE QUALITY, ECONOMY AND ADVANCED DESIGN FEATURES

- SPEEDLINE Type C Stub Ends were developed to provide a more economical stub end than either MSS Types A and B or ANSI for light wall process lines.
- Rigid standards have been established by SPEEDLINE to produce a quality stub end very closely approaching in performance the more expensive MSS Types A and B.
- None of the standardization sources such as MSS and ASA (now ANSI) has published standards covering Type C Stub Ends but SPEEDLINE has established its own exacting quality standards.

  MSS—Manufacturers Standardization Society
  ASA—American Standards Association
  ANSI—American National Standards Institute

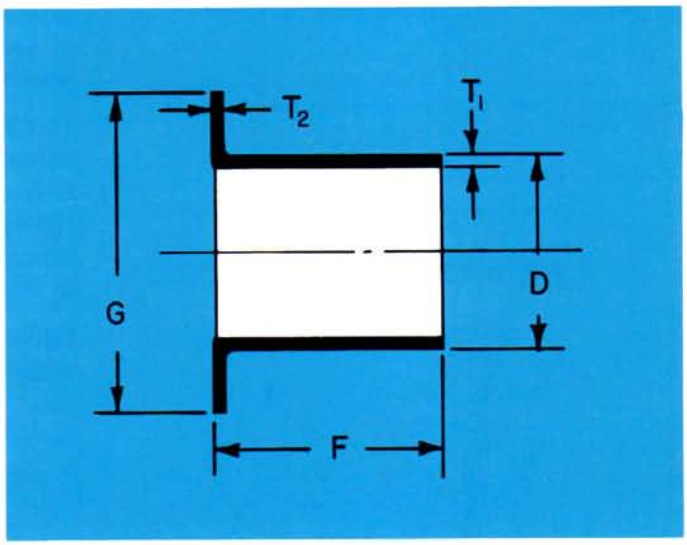
- SPEEDLINE Type C Stub Ends cost much less but incorporate many of the Type B features. In most cases a machined lap face is not required for low pressure applications.
- SPEEDLINE Stub Ends are cold formed from pipe that is made to rigid SPEEDLINE specifications.
- Specially designed SPEEDLINE forming equipment ensures quality stub ends with minimum inside corner radius and carefully controlled lap thickness.
- Every SPEEDLINE Type C Stub End is annealed and pickled to assure full corrosion resistance.
- Smooth finish, free of surface imperfections, is easy to polish when high lustre is required for appearance.
- All SPEEDLINE Schedule 10 and 40 Stub Ends are beveled to facilitate welding in accordance with MSS SP43. SPEEDLINE bevels all wall thicknesses over .083" even though standard specifications do not require beveling under .125" wall.
- SPEEDLINE Type C Stub Ends can be furnished with belled end for socket joining to pipe. (Back-up flange included).

Speedline®

TYPE C STUB ENDS

STAINLESS STEELS
Types 304L, 316L, Alloy 20Cb-3
NICKEL 200, **MONEL** 400

Other alloys on application.



Long length Stub Ends available on application.

See page 33 for Back-Up Flanges

Pipe Size I.P.S.	O.D. D	Lap O.D. G	LENGTHS* Standard Production (MSS Length) F	LENGTHS* On Application (ASA Length) F	Min. Wall T_2	Sch. 5S Wall T_1	Sch. 10S Wall T_1
½	.840	1⅜	2	3	87½% of T_1 (Nominal Wall)	.065	.083
¾	1.050	1 11/16	2	3		.065	.083
1	1.315	2	2	4		.065	.109
1¼	1.660	2½	2	4		.065	.109
1½	1.900	2⅞	2	4		.065	.109
2	2.375	3⅝	2½	6		.065	.109
2½	2.875	4⅛	2½	6		.083	.120
3	3.500	5	2½	6		.083	.120
4	4.500	6 3/16	3	6		.083	.120
6	6.625	8½	3½	8		.109	.134

*Lengths to 9" or any intermediate length in one piece. Longer lengths can be furnished with machine welded additions. Lengths to 16" can be annealed and pickled after welding.

All dimensions are in inches. See page 105 for dimensional tolerances.

Pipe schedules 5S, 10S, 40S, are in accordance with ANSI B36.19.

Weights of fittings are shown on page 108.

6" Stub Ends in Sch. 5 and all SPEEDLINE Sch. 10. Stub Ends are beveled in accordance with MSS SP-43.

Wall thickness will not be less than 87½% of nominal pipe wall in accordance with MSS SP-43.

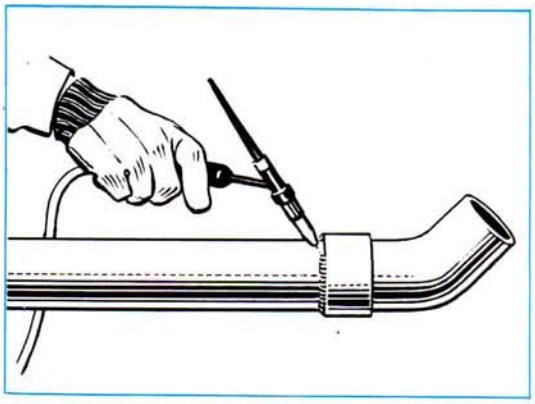
All SPEEDLINE fittings are permanently marked by electro-chemical etch that includes SPEEDLINE trademark, type of metal, pipe size, schedule and manufacturing code in accordance with MSS SP-43 and ANSI B16.9.

Stainless Steel fittings are supplied fully annealed and pickled. Other metals are heat treated as required by accepted practice and are adequately cleaned to insure maximum corrosion resistance.

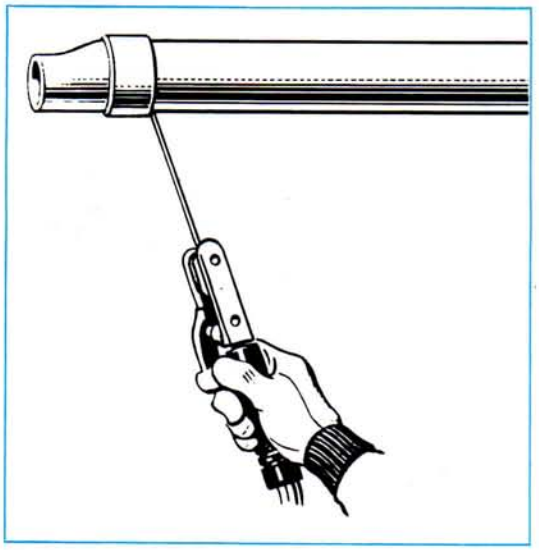
Smooth pickle finish, free of surface imperfections, is easy to polish when high lustre is required for appearance.

THE *Speedline* ALIGNING CONNECTOR

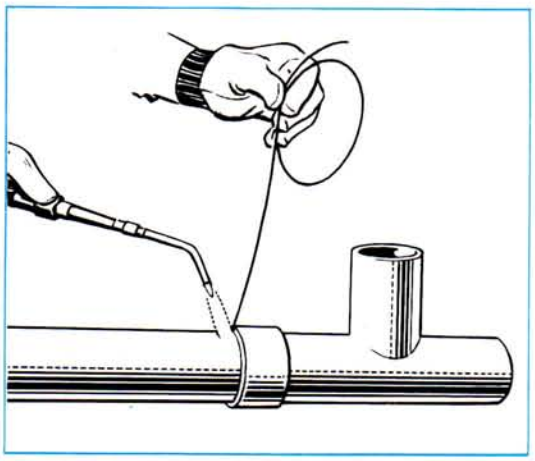
SPEEDS ALIGNMENT, ALSO MAKE-UP OF WELDED, BRAZED OR SOLDERED CONNECTION OF PIPE AND FITTINGS



Making a welded joint using a TIG torch without filler metal.



Making a welded joint using a covered electrode.



Making a brazed joint using an oxy-acetylene torch and a silver brazing alloy.

There will be no pipe misalignment or "icicles" at joints with Speedline Aligning Connectors. This inexpensive connector fits over the pipe and *Speedline Fittings,* to permit speedy welding, brazing or soldering of tight, leakproof, socket type joints. In-place pre-assembly and positive alignment *prior* to welding or brazing, reduces installation time and costs for the most complicated process piping systems.

Speedline Aligning Connectors also make it easy to tie in low cost, light wall Schedules 5 or 10 pipe and *Speedline Fittings* with existing heavy wall lines. The extra straight section on *every* end of *every* Speedline corrosion-resistant fitting allows for *direct* assembly of Aligning Connectors to any or all ends of the fittings.

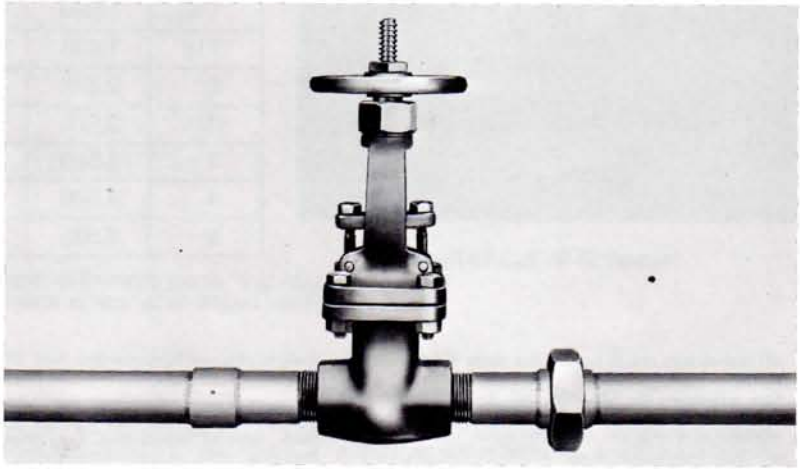
The Speedline Aligning Connector adds socket connecting advantages to any *Speedline Fitting without* sacrificing the versatility of tangential design. One or more ends of a *Speedline Fitting* can be socket joined (with Aligning Connector) while other ends may be flanged, butt welded, connected with unions or stub ends.

When *only* socket welds are specified for all process piping, consider *Speedline Belled End Fittings.* See Page 39 for details.

ASSEMBLY ADVANTAGES:

- ☐ **No end preparation**
- ☐ **Minimum alignment time**
- ☐ **Gas purge can be eliminated**
- ☐ **Filler metal not needed**
- ☐ **Less welding skill required**
- ☐ **In-place pre-assembly expedites welding**

Simplifies joining of light wall pipe to heavy wall threaded pipe for connecting to screwed valves or other components.

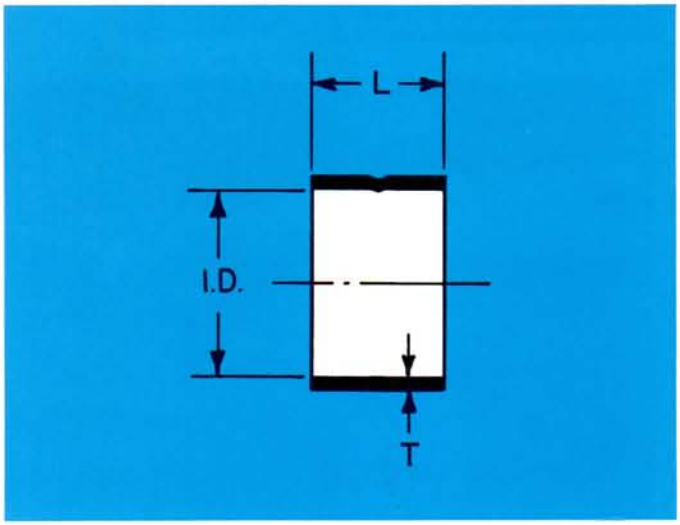


Speedline®

ALIGNING CONNECTOR

STAINLESS STEELS
Types: 304L, 316L, Alloy 20Cb-3
NICKEL 200, **MONEL** 400

Other alloys on application.



Designed to fit over ends of pipe and Speedline Fittings to facilitate assembly. Also simplifies hook-up of light wall pipe and fittings to existing heavy wall lines.

PIPE SIZE I.P.S.	INSIDE DIA. (Nominal) I.D.	LENGTH L	WALL* T
½	.840	1⅛	.083
¾	1.050	1⅛	.083
1	1.315	1¼	.109
1¼	1.660	1¼	.109
1½	1.900	1⅜	.109
2	2.375	1⅜	.109
2½	2.875	1⅝	.120
3	3.500	1¾	.120
4	4.500	1¾	.120
6	6.625	2	.134

* Standard stocks to be used with Sch. 5 or 10 piping. Sch. 40S on application.

All dimensions are in inches.

Nominal I.D. dimensions are in accordance with ANSI B36.19 O.D. dimensions for pipe.

Weights of fittings are shown on page 108.

Wall thickness will not be less than 87½% of nominal pipe wall.

Stainless Steel Aligning Connectors are fabricated from annealed and pickled material. Other metals are heat treated as required by accepted practice and are adequately cleaned to insure maximum corrosion resistance.

All SPEEDLINE fittings are permanently marked by electro-chemical etch that includes SPEEDLINE trademark, type of metal, pipe size, schedule and manufacturing code in accordance with MSS SP-43 and ANSI B16.9.

THE Speedline UNION

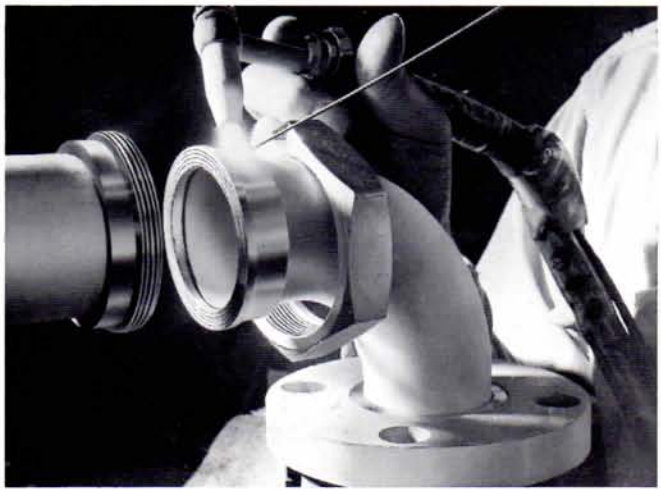
SPEEDLINE Gasket Seated Union features stainless ferrules with cadmium-plated carbon steel nut.

Designed primarily for joining light wall pipe Schedules 5S and 10S

TYPE 316 STAINLESS STEEL FERRULES with CADMIUM-PLATED CARBON STEEL NUTS

(Ferrules and nuts in other metal types available on application)

Assemble on pipe or SPEEDLINE Fittings by expanding method.



Socket Weld or Butt Weld to Pipe or SPEEDLINE Fittings

SPEEDLINE design eliminates the leaking frequently encountered with corrosion-resistant ground joint screwed unions.

Three designs are available:

Type PE provides ferrules that are serrated on the I.D. so that pipe or SPEEDLINE Fittings may be expanded or rolled-in, similar to the SPEEDLINE T/D Insert Flange described on page 29.

Type PW (Welding) features a design that can be socket welded or silver brazed.

Type PBW is designed for butt-welding to pipe or fittings. Ferrules are sized to match the pipe schedule at the weld end and are long enough for ease in welding.

All designs feature a concentric grooved gasket face on both ferrules. Gaskets may be ordered with unions, as a separate item.

SPEEDLINE Unions are bimetallic (stainless steel ferrules with cadmium-plated carbon steel nut). This eliminates the galling and seizing problems often experienced with threaded joints in stainless steels and other corrosion-resistant metals.

Standard production SPEEDLINE Unions have ferrules of Type 316 Stainless Steel. Ferrules in other corrosion-resistant metals can be supplied on application.

If cadmium-plated carbon steel nuts cannot be used because of the particular application or processing conditions, SPEEDLINE Unions can be specified with stainless steel or other corrosion-resistant metal nuts *on special order.*

DESIGN FEATURES

Bimetallic for easier disassembly.

Gasket seated to eliminate leakage problems.

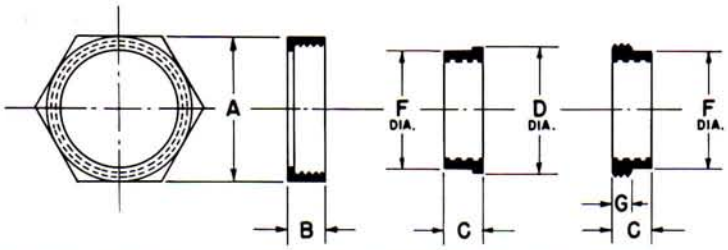
A demountable joint designed specifically for light wall process piping.

Available in types for socket welding, for butt welding and for expanding.

Simplifies installation of pipe or SPEEDLINE Fittings.

Can be ordered with stainless steel or other corrosion-resistant metal nuts to suit service requirements.

TYPE PE UNION Available Type 316 ½" through 1½"

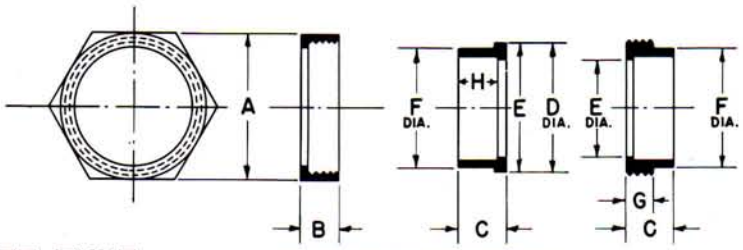


THE *Speedline* UNION . . . EXPANDING TYPE

Designed for assembly by expanding or rolling in, same as Speedline T/D Insert Flange

PIPE SIZE I.P.S.	NUT		FERRULE				‡GASKET SIZE	
	A	B	C	D*	F	G	THICKNESS	OD/ID
½	1 5/8	13/16	5/8	1 3/8	1 3/16	3/8	1/16	1 11/32 x 3/4
¾	2 1/4	13/16	5/8	1 13/16	1 5/8	3/8	1/16	1 25/32 x 15/16
1	2 1/2	13/16	5/8	2	1 7/8	3/8	1/16	2 1/32 x 1 3/16
1 1/4	3	13/16	5/8	2 9/16	2 3/8	3/8	1/16	2 17/32 x 1 9/16
1 1/2	3 1/2	7/8	3/4	2 15/16	2 3/4	3/8	1/16	2 29/32 x 1 13/16

TYPE PW UNION Available Type 316 ½" through 4" I.P.S.

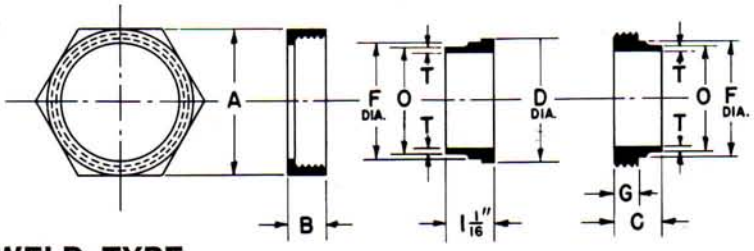


THE *Speedline* UNION . . . SOCKET TYPE

For welding or silver brazing.

PIPE SIZE I.P.S.	NUT		FERRULE						‡GASKET SIZE	
	A	B	C	D*	E*	F	G	H	THICKNESS	OD/ID
½	1 5/8	13/16	5/8	1 3/8	3/4	1 3/16	3/8	½	1/16	1 11/32 x 3/4
¾	2 1/4	13/16	5/8	1 13/16	15/16	1 5/8	3/8	½	1/16	1 25/32 x 15/16
1	2 1/2	13/16	3/4	2	1 3/16	1 7/8	3/8	5/8	1/16	2 1/32 x 1 3/16
1 1/4	3	13/16	3/4	2 9/16	1 9/16	2 3/8	3/8	5/8	1/16	2 17/32 x 1 9/16
1 1/2	3	7/8	3/4	2 11/16	1 3/4	2 1/2	3/8	5/8	1/16	2 21/32 x 1 13/16
2	3 1/2	7/8	3/4	2 15/16	2 1/4	2 3/4	3/8	5/8	1/16	2 29/32 x 2 1/4
2 1/2	4	1 1/16	7/8	3 1/2	2 7/8	3 3/8	5/8	3/4	1/16	3 17/32 x 2 11/16
3	4 3/4	1 1/16	7/8	4	3 1/2	3 3/4	5/8	3/4	1/16	4 1/32 x 3 5/16
4	5 1/2	1 3/16	1	5	4 1/2	4 3/4	3/4	7/8	1/16	5 1/32 x 4 7/16

TYPE PBW UNION Available Type 316 ½" through 4" I.P.S.



THE *Speedline* UNION . . . BUTT WELD TYPE

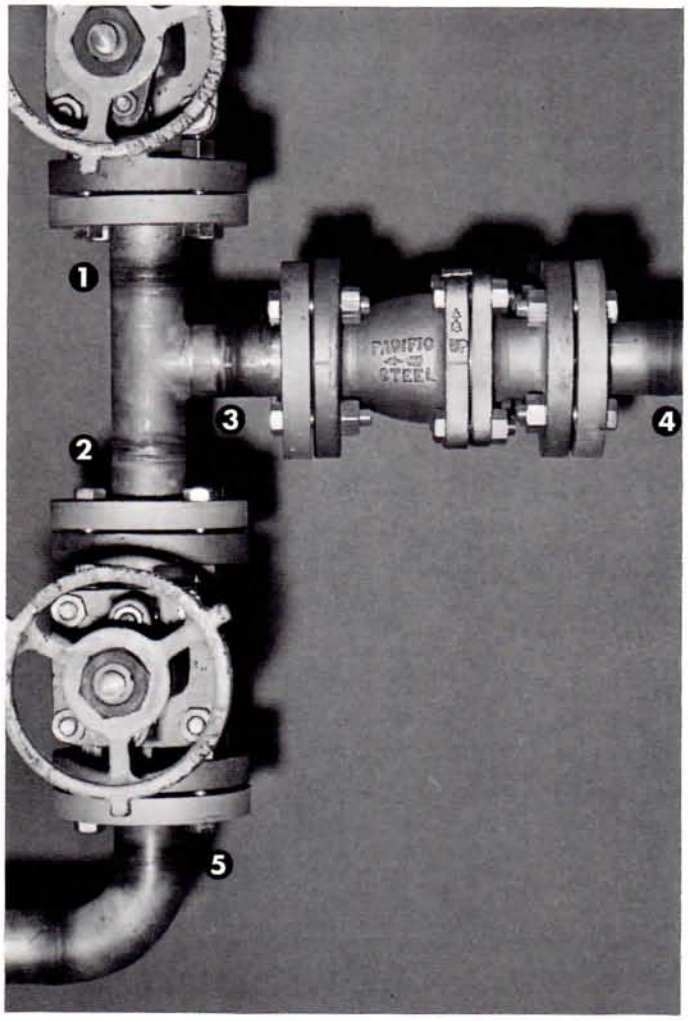
(3) PIPE SIZE I.P.S.	(1) NUT		FERRULES (1) (2)								‡ GASKETS			
												I.D.		
	A	B	(4) O.D. O	SCH. 5 T	(4) SCH. 10 T	(4) SCH. 40 T	C	D*	F	G	O.D.	SCH. 5	SCH. 10	SCH. 40
½	1 5/8	13/16	.840	.065	.083	.109	1 1/4	1 3/8	1 3/16	3/8	1 11/32	23/32	11/16	5/8
¾	2 1/4	13/16	1.050	.065	.083	.113	1 1/4	1 13/16	1 5/8	3/8	1 25/32	29/32	7/8	13/16
1	2 1/2	13/16	1.315	.065	.109	.133	1 1/4	2	1 7/8	3/8	2 1/32	1 3/16	1 3/32	1 1/16
1 1/4	3	13/16	1.660	.065	.109	.140	1 1/4	2 9/16	2 3/8	3/8	2 17/32	1 17/32	1 7/16	1 3/8
1 1/2	3	7/8	1.900	.065	.109	.145	1 1/4	2 11/16	2 1/2	3/8	2 21/32	1 25/32	1 11/16	1 5/8
2	3 1/2	7/8	2.375	.065	.109	.154	1 1/4	2 15/16	2 3/4	3/8	2 29/32	2 1/4	2 5/32	2 1/16
2 1/2	4	1 1/16	2.875	.083	.120	.203	1 1/2	3 1/2	3 3/8	5/8	3 17/32	2 23/32	2 5/8	2 15/32
3	4 3/4	1 1/16	3.500	.083	.120	.216	1 1/2	4	3 3/4	5/8	4 1/32	3 11/32	3 1/4	3 1/16
4	5 1/2	1 3/16	4.500	.083	.120	.237	1 5/8	5	4 3/4	3/4	5 1/32	4 11/32	4 1/4	4 1/32

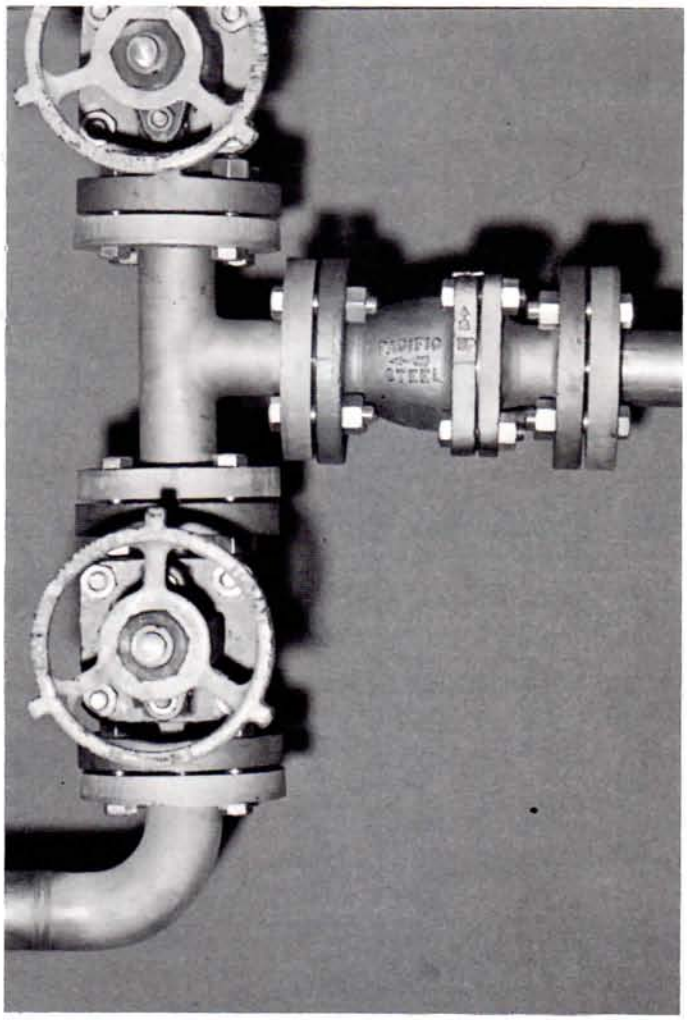
(1) Nuts and ferrules are interchangeable with same size PW union.
(2) Ferrules extend approx. ¾" beyond nut.
(3) Orders must specify size and schedule.
(4) Wall .083 and under . . . weld ends are plain.
Over .083 wall . . . weld ends have standard 37½° bevel.

‡May be ordered in Teflon or Neoprene. Other gasket materials available on application.
*Nearest 1/16".

Fewer welds can mean savings in time and costs...

Five welds and the cost of stub ends could have been eliminated in the piping installation shown at left below . . . if Speedline Fittings and T/D Insert Flanges had been used instead of ordinary welding fittings and flanges. Compare the installation on the right. Note how the extra straight section — a feature common to all Speedline Fittings — provides ample clearance for adding flanges where needed. And, you can attach the Speedline T/D Insert Flange to pipe or fittings with a simple expanding operation . . . no clamps are needed. Exclusive Taper Design cuts installation time and costs, too, because flanges can be rotated to align bolt holes.





THE Speedline® T/D* INSERT FLANGE

A PATENTED DESIGN THAT REDUCES FLANGE ASSEMBLY COSTS

A Speedline T/D Insert Flange consists of a stainless steel (or other corrosion resistant metal) insert in a carbon steel flange. It was developed to provide a less expensive method for flanging corrosion resistant pipe and Speedline Fittings.

Flanges may be expanded or welded to any or all ends of pipe and Speedline Fittings as required. Assembly is easier and less costly because the need for special tools is minimized and bolt hole alignment is never a problem.

Taper Design Insert Flanges offer significant cost-saving differences particularly when compared with welding neck, slip-on flanges or stub ends and back-up flanges.

Standard ASA thickness and drilling.
—Meets specification requirements.

No bolt hole alignment difficulties.
—Flange can be rotated.

Patented T/D (Taper Design) feature speeds assembly.
—No need for special clamps when expanding.

Taper Design assures full support for insert during expanding.
—To insure metal flow of pipe or fitting into the insert serrations.

Speedline pipe expander is only special tool needed.
—Good expanding technique can be quickly acquired.

Solves assembly problems in hazardous areas.
—No welder or welding equipment needed.

Expanded joints can speed pipeline maintenance
—T/D Insert Flanges simplify hook up to existing piping or fittings in the field.

Designed for maximum unit gasket loading.
—Concentrated force and concentric grooved insert face insures leakproof performance.

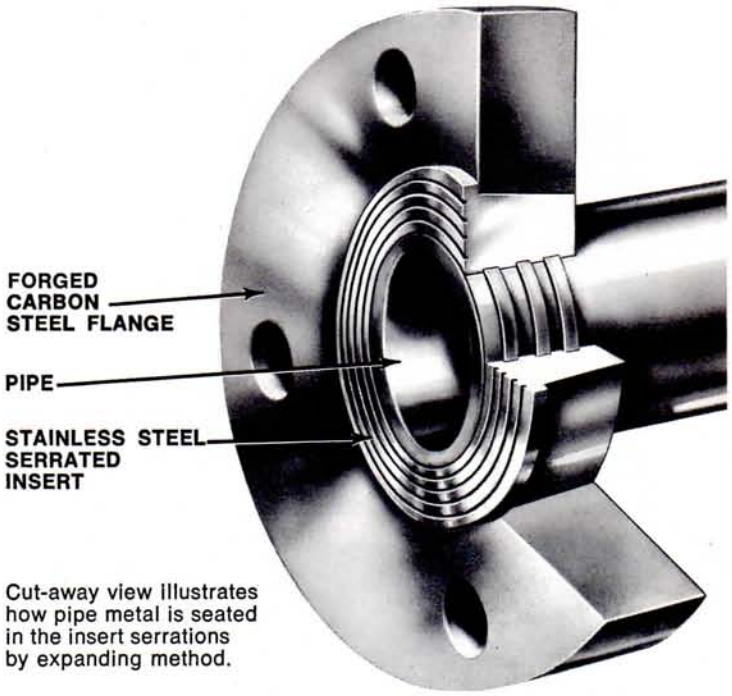
T/D Insert Flanges provide a demountable joint that requires no special pipe or fitting end preparation.
—Beveling, grooving, flaring, threading can be eliminated.

Square shoulder at face of insert.
—No drift back and leakers in cyclical temperature service.

Can also be used as welding flange.
—Rotatability is not affected even if welded front and back.

Pipe cutting to exact length is uncomplicated.
—Make allowance only for gasket thickness.

*TAPER DESIGN/TM U.S. Patent No. 3,284,112.



Cut-away view illustrates how pipe metal is seated in the insert serrations by expanding method.

Installed cost is less than stub end and backup flange.
—With equal bolt-hole alignment advantage.

Corrosion resistant metal is used for insert only.
—A design feature that contributes to lower installed costs.

Any type of metal can be specified for the insert.
—Choose from Stainless Steels, Monel, Nickel and other corrosion resistant alloys. Inserts machined from spuncast, hollow bar, forgings or bar stock at manufacturer's option, unless otherwise specified.

Speedline Fittings may be ordered with T/D Insert Flanges expanded on ends as specified.
—Or welded to any or all ends of fittings or pipe.

PRESSURE TEMPERATURE RATINGS SPEEDLINE T/D INSERT FLANGES (150# with stainless steel inserts)

Ratings are maximum allowable non-shock pressures

Service Temperature Deg. F (1) (2)	Allowable Pressure p.s.i.g.
-20° to 100°	275
150°	255
200°	240
250°	225
300°	210
350°	195
400°	180
450°	165
500°	150

(1) Ratings may be interpolated between temperatures shown.
(2) The temperature is that on the inside of the pressure retaining structure.

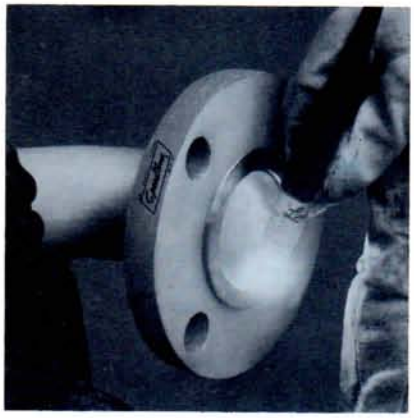
USE Speedline® T/D® INSERT FLANGES TO SPEED ASSEMBLY AND TO REDUCE FLANGING COSTS

Speedline T/D Insert Flanges can be quickly assembled, as required, on any Speedline Fitting or length of pipe.

A matching taper on both flange and insert provides positive mechanical strength during assembly and in service.

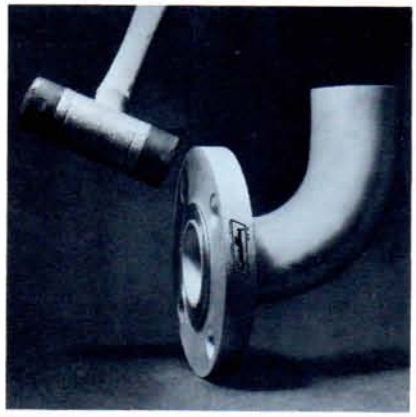
A simple expanding operation will secure the Speedline T/D Flange to any or all ends of Speedline Tangential fittings or length of pipe.

To align bolt holes, simply rotate the flange until it matches drilling of the mating flange or component.

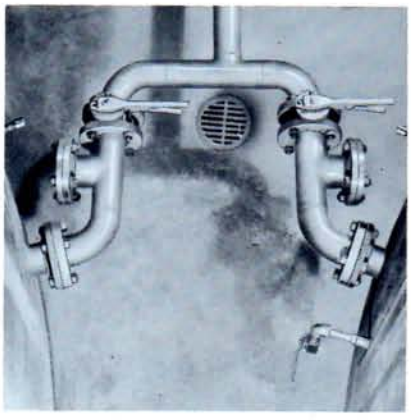


Speedline T/D Insert Flanges may also be welded to pipe or fittings without sacrificing rotatability or efficiency.

Taper Design increases bolt tightening compressive forces to insure structurally sound and leak-proof joints.



When expanding or welding is completed, a few taps with a mallet will free flange for quick bolt hole alignment.



Flange one end or all ends. T/D Insert Flanges provide design freedom and many cost-saving assembly advantages.

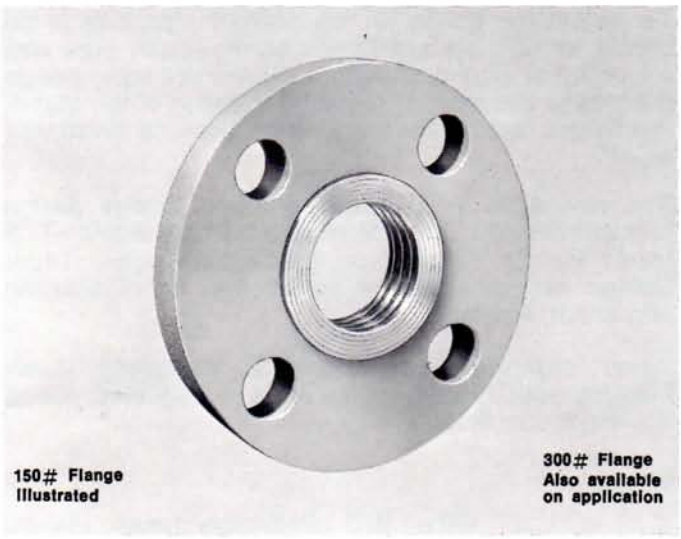
Speedline®

T/D® INSERT FLANGE

(Taper Design)

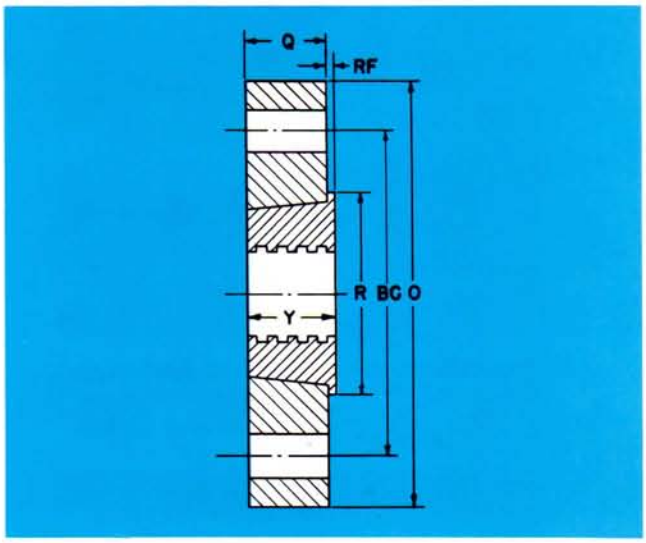
CORROSION RESISTANT METAL INSERT IN A FORGED CARBON STEEL FLANGE

INSERT METALS: STAINLESS STEEL Type 316, Alloy 20
NICKEL 200, **MONEL** 400
Other alloys on application.



150# Flange Illustrated

300# Flange Also available on application



T/D® INSERT FLANGE - 150# STD

Pipe Size I.P.S.	Flange Dia. O	Flange Thickness Q	Bolt Circle Dia. BC	No. & Bolt Hole Dia.	Gasket Face Dia. Nearest 1/16" R	Raised Face Thickness RF	Length of Insert Y	Bolt Data	‡Gasket Size	
									Thickness	OD/ID
½	3½	7/16	2⅜	4 - ⅝	1⅜	1/16	½	4 - ½ x 1¾	1/16	1¾ x ¾
¾	3⅞	½	2¾	4 - ⅝	1⅝	1/16	21/32	4 - ½ x 2	1/16	2⅛ x 1
1	4¼	9/16	3⅛	4 - ⅝	1 15/16	1/16	21/32	4 - ½ x 2	1/16	2½ x 1¼
1¼	4⅝	⅝	3½	4 - ⅝	2⅜	1/16	11/16	4 - ½ x 2¼	1/16	2⅞ x 1½
1½	5	11/16	3⅞	4 - ⅝	2 11/16	1/16	¾	4 - ½ x 2¼	1/16	3¼ x 1¾
2	6	¾	4¾	4 - ¾	3 3/16	1/16	27/32	4 - ⅝ x 2¾	1/16	4 x 2¼
2½	7	⅞	5½	4 - ¾	3¾	1/16	15/16	4 - ⅝ x 3	1/16	4¾ x 2¾
3	7½	15/16	6	4 - ¾	4 7/16	1/16	1	4 - ⅝ x 3	1/16	5¼ x 3⅜
4	9	15/16	7½	8 - ¾	5½	1/16	1⅛	8 - ⅝ x 3	1/16	6¾ x 4⅜
6	11	1	9½	8 - ⅞	7¾	3/32	1⅛	8 - ¾ x 3¼	1/16	8⅝ x 6⅜
8	13½	1⅛	11¾	8 - ⅞	10	⅛	1⅜	8 - ¾ x 3¼	1/16	10⅞ x 8⅜
10	16	1 3/16	14¼	12 - 1	12¼	⅛	1⅜	12 - ⅞ x 3½	1/16	13¼ x 10½

‡May be ordered in Teflon or Neoprene. Other materials on application.
Blind T/D Insert Flange also available to same dimensions, except no bore.

Reducing Insert Flanges. See page 32.
Forged Steel Back-up Flange. See page 33.

All dimensions are in inches.

Flange O.D., thickness and drilling conform to specification ANSI B16.5.

Gasket face has machined concentric V grooves.

Forged carbon steel flange specification ASTM A181 Grade II or A105.

Flange weights are listed on Page 108.

Sizes 8" and 10" are recommended for welded assembly only.

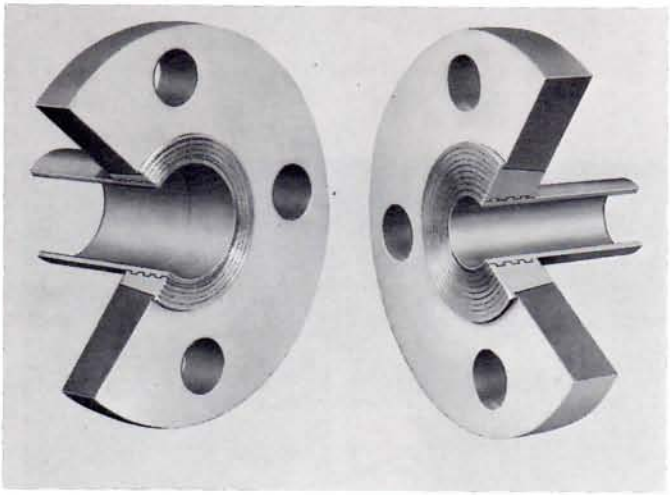
Test data shown on Page 106.

Speedline®

T/D® REDUCING INSERT FLANGE

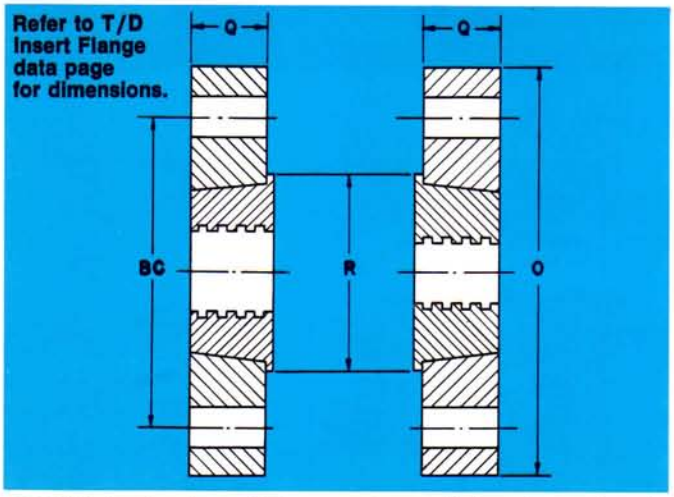
CORROSION RESISTANT METAL INSERT IN A FORGED CARBON STEEL FLANGE

INSERT METALS: STAINLESS STEEL Type 316, Alloy 20
NICKEL 200, **MONEL** 400
Other alloys on application.



T/D Insert Flange 150# Std.

T/D Reducing Insert Flange 150# Std.



T/D Reducing Insert Flanges have all the dimensional characteristics of a T/D Insert Flange, except that insert has smaller bore to accommodate reduction in size of pipe—as shown in drawings and pictures above.

Reducing flanges can be specified when a demountable connection is required in conjunction with a reduction in size of pipeline. If an abrupt change in pipe size is objectionable, consider use of Speedline Concentric or Eccentric Reducers.

To permit the flange on the smaller pipe size to be bolted to the standard flange on the larger pipe size (or on other piping components) the reducing flange must have dimensions identical to those of the standard flange, except for the smaller bore, as illustrated at left.

The Speedline T/D Reducing Insert Flange design incorporates all the advantages of the regular T/D Insert Flange detailed on preceding pages. Taper Design assures ease of installation by eliminating alignment problems.

When ordering Speedline T/D Reducing Insert Flanges, specify the two pipe sizes being joined, giving the larger size first.

Example:

3″ x 1½″ 150# T/D Reducing Insert Flange Type 316 S.S.

This indicates that flange is going to be used on 1½″ size pipe but will be bolted to a 3″ 150# flange.

Another ordering method is to specify the smaller pipe size and the outside diameter of the flange required for the larger pipe size.

Example cited above would then read:

1½″ x 7½″ O.D. 150# T/D Reducing Insert Flange Type 316 S.S.

Reference to chart below will show that 7½″ is the O.D. for a 3″ 150# flange—to which the reducing flange will be bolted.

Flange Diameters
(Inches)

Pipe Size I.P.S.	¾	1	1¼	1½	2	2½	3	4	6	8 *	10
150#	3⅞	4¼	4⅝	5	6	7	7½	9	11	13½	16
300#	4⅝	4⅞	5¼	6⅛	6½	7½	8¼	10	12½	15	17½

All dimensions are in inches.

Flange O.D., thickness and drilling conform to specification ANSI B16.5.

Gasket face has machined concentric V grooves.

Forged carbon steel flange specification ASTM A181 Grade II or A105.

Flange weights are listed on Page 108.

TAPER DESIGN/TM U.S. Patent No. 3,284,112.

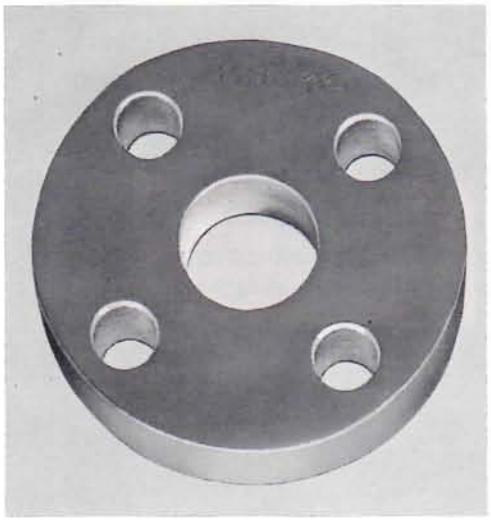
Sizes 8″ and 10″ are recommended for welded assembly only.

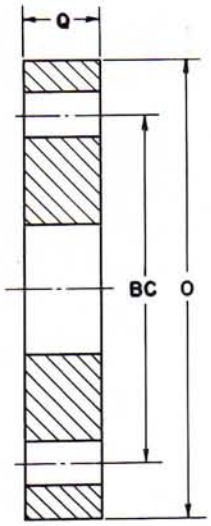
Test data shown on Page 106.

Speedline®

BACK-UP FLANGE
Forged Carbon Steel

These flanges are for use with SPEEDLINE Stub Ends and are made to ANSI dimensions.





Standard 150# Drilling—Flat Face

Pipe Size I.P.S.	Flange Dia. O	Flange Thickness Q	Bolt Circle Dia. BC	No. & Bolt Hole Dia. C
½	3½	7/16	2⅜	4—⅝
¾	3⅞	½	2¾	4—⅝
1	4¼	9/16	3⅛	4—⅝
1¼	4⅝	⅝	3½	4—⅝
1½	5	11/16	3⅞	4—⅝
2	6	¾	4¾	4—¾
2½	7	⅞	5½	4—¾
3	7½	15/16	6	4—¾
4	9	15/16	7½	8—¾
6	11	1	9½	8—⅞

Dimensions are in inches.
Flanges to 300# design available on application.

Forged carbon steel flange specification ASTM A181 Grade II or A105.

SPEEDLINE back-up flanges can be used with SPEEDLINE Type C or MSS Type B Stub Ends.

Savings are measurable with longer length Speedline Fittings.

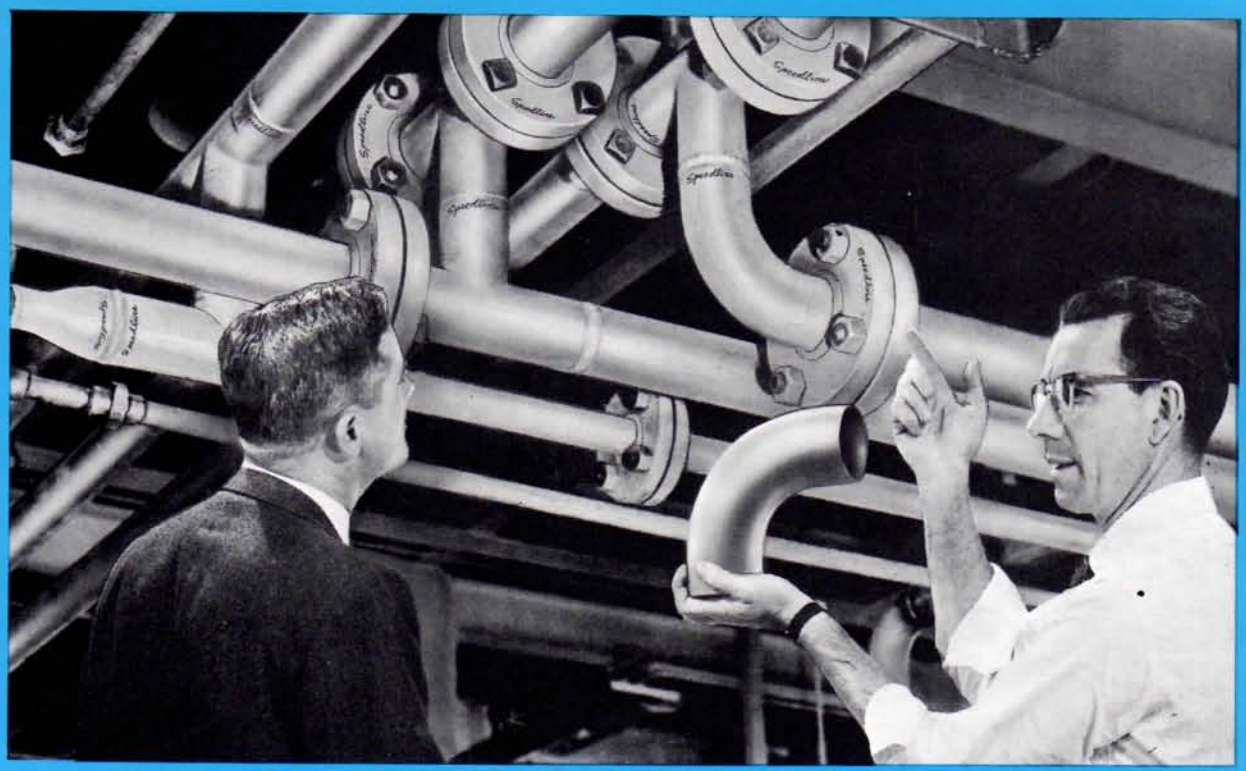
DISCOVER NEW PIPING ECONOMY WITH Speedline® FITTINGS

Speedline®
"EXTRA LENGTH" FEATURE makes butt welding easier . . . less costly.

Speedline®
ALIGNING CONNECTORS simplify joining of light-wall pipe.

Speedline®
FITTINGS permit use of all connecting methods.

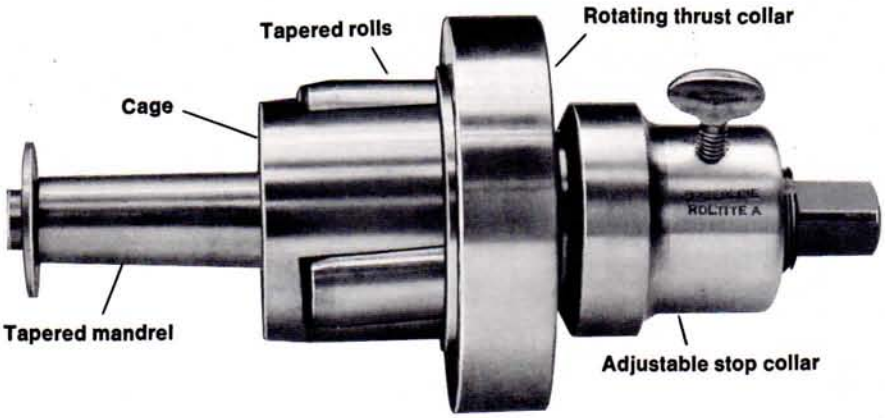
Speedline®
FLANGES reduce assembly costs . . . eliminate welding.



THE *EXTRA LENGTH* FEATURE OF SPEEDLINE FITTINGS
ADDS COST-SAVING VERSATILITY TO PROCESS PIPING INSTALLATIONS

Speedline® ROL-TITE® EXPANDER Designed for Parallel Expanding

Speeds Assembly of Pipe or SPEEDLINE Fittings and T/D Insert Flanges



WHEN ORDERING SPECIFY

- ☐ ROL-TITE
- ☐ PIPE SIZE
- ☐ PIPE SCHEDULE

ROL-TITE DESIGN FEATURES

Rolls and mandrels have matching tapers, a feature that makes parallel rolling or expanding possible. The full working surface of the rollers is employed during the entire expanding operation to insure uniform seating of metal in all serrations, front to back of the insert.

MADE BETTER TO LAST LONGER

Speedline Rol-Tite expanders are manufactured with care and skill to insure trouble-free performance on the job. All steel parts are heat treated to increase service life. Mandrels and rolls are hardened tool steel. The cage assembly and rotating thrust collar are alloy steel.

Rol-Tite expanders have been designed for easy changeover from one schedule to another in a given pipe size.

Mandrel supplied with expander is for schedule specified. At the same time or at a later date, additional mandrels may be purchased separately.

INTERCHANGEABILITY DATA

Pipe sizes ½" ¾" 1" 1¼" 1½"
Rol-Tite expanders up to and including 1½" size can be used for Schedules 5 or 10 . . . the only thing needed to make change from one schedule to another is the proper mandrel.

Schedule 5 or Schedule 10 mandrels may be purchased separately.

Schedule 40 in these sizes requires a Schedule 40 expander.

Pipe sizes 2" 2½" 3" 4"
Rol-Tite expanders for 2" size and over can be used for Schedules 5, 10 or 40 . . . the only thing needed to make change from one schedule to another is the proper mandrel. Mandrels for any of the three schedules may be purchased separately.

Stop collars for each size are interchangeable for all three schedules. All parts are permanently marked for quick identification. Sizes over 4" IPS available on application.

Gain these advantages with Rol-Tite expanders

- Engineered to produce uniform expansion, front to back of serrated insert.
- Parallel rolling promotes flow of metal into all serrations.
- Flow of metal into all serrations assures a structurally sound, leak tight joint.
- Specially designed short mandrel provides adequate clearance for expanding Speedline bends and tees.
- Simplified expanding procedure does not utilize torque data or torque wrenches and requires no special mechanical skills.
- Proper expansion is based on the amount of mandrel travel and is controlled by the stop collar.
- Results in a smooth, burnished I.D. finish in area of expansion. Eliminates need for additional rolling often required to smooth troublesome ridges caused by some expander designs.
- All wear parts are heat treated tool steel or alloy steel to increase service life.
- Replacement cage assemblies, mandrels, stop collars and roller sets are readily available.

AN EASY, FOUR STEP INSTALLATION PROCEDURE FOLLOWS . . .

Speedline® ROL-TITE EXPANDING PROCEDURE

The procedure detailed here utilizes proven engineering data on the metal flow that takes place during the expansion of the pipe or Speedline Fitting into the insert serrations.

Previous Speedline data on expanding was based on torque values, as compared with this approach which is based on penetration of metal into the serrations by controlled mandrel travel.

This new procedure simplifies expanding because it compensates for variables such as hardness of different metals, dimensional tolerances, operator's skill, etc., resulting in consistently sound joints.

The four-step procedure outlined below eliminates need for expensive special equipment and makes it a simple matter for anyone in the assembly crew to make expansions with confidence.

SIMPLIFIED 4 STEP PROCEDURE

Good expanding results, as with nearly all mechanical accomplishments, begin with careful preparation and good shop or field practices. Cleanliness of pipe and fittings plus tool care, maintenance and lubrication of expander before and during procedure will contribute much to ease of operation and the results obtained.

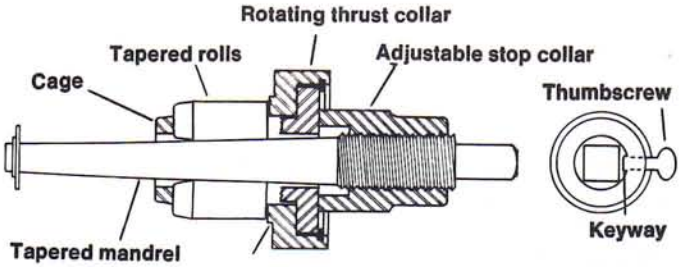
Speedline Fittings do not require any special end preparation prior to expanding into the flange.

It is always good practice to carefully inspect pipe to be used on the job. Make sure it is the correct size, schedule, analysis and free of any surface damage or excessive O.D. or I.D. weld bead.

If removal of any of the weld bead is indicated, this can be accomplished by manually grinding. Grind flush, conforming to curvature of pipe.

Before starting each expanding job select Rol-Tite expander of proper pipe size and be sure it is fitted with proper size mandrel for the wall thickness being used (Schedule 5, 10 or 40).

EXPANDER PARTS



To insure long tool life and to expedite operation keep expander clean and free of dirt, grit or abrasive matter at all times. Expander should be kept well lubricated during use to insure maximum efficiency.

Cut Pipe Square

Deburr

Clean pipe and fitting ends

Secure pipe or fitting in vise

Position units for expanding flush with insert face.

Slide expander cage forward.

Insert expander.

Shoulder fits into I.D. of insert.

Thrust collar face tight against gasket face.

STEP #1

A good expansion begins with square cut pipe that has been deburred and cleaned.

End of pipe or fitting to be expanded and the insert serrations should be wiped with a commercial solvent or degreaser to assure removal of any foreign matter.

An ordinary bench vise may be used to hold T/D Insert Flange in an upright position, with gasket face of insert facing operator. (Fig. #1)

If preferred, a pipe vise may be used to hold length of pipe or fitting.

Pipe or fitting initially should be positioned with end flush with insert face. (Fig. #2)

STEP #2

Slide cage assembly all the way forward on the mandrel. (Fig. #3)

Insert expander (Fig. #4) until shoulder on face of thrust collar slips into I.D. of insert and face of thrust collar is tight against gasket face to insert. (Fig. #5)

Shoulder on face of thrust collar will move pipe or fitting that is to be expanded back from face of insert about 1/32". (Fig. #5)

Fig. 1

Fig. 2

Fig. 3

Fig. 4

STEP #3

Maintain Step #2 cage position.

Maintain cage position illustrated (Fig. 5) and turn mandrel clockwise. Mandrel will move forward automatically, as rollers engage pipe or fitting.

Continue turning mandrel until snug tight condition occurs. Withdraw expander by turning mandrel counter-clockwise.

Turn mandrel clockwise till snug tight. (No wobble with expander removed.)

Snug tight means metal to metal contact between pipe (or fitting) and I.D. of insert, with just enough additional turning of mandrel, so that, with expander withdrawn, there is no manually detectable wobble between the insert and pipe.

If there is wobble repeat procedure.

If wobble is detected, re-insert expander and repeat above procedure. After again reaching metal to metal contact, increase the number of additional turns used previously. Withdraw expander and re-check for snug tight.

Do not over expand.

It is important not to over expand at this point. After initial expansions are made the operator will acquire the proper "feel" so that snug tight condition can be attained quickly, usually after the first or second attempt.

Some operators prefer a short wrench (e.g. 8" open end for 2" size) to make it easier to gauge when the snug tight condition occurs.

Check positioning of units.

It is also important to maintain cage position during this step to prevent pipe or fitting that is being expanded from moving beyond the insert face; neither should they be recessed more than provided for by the thrust collar shoulder. Adjust if necessary by tapping flange or pipe or fitting.

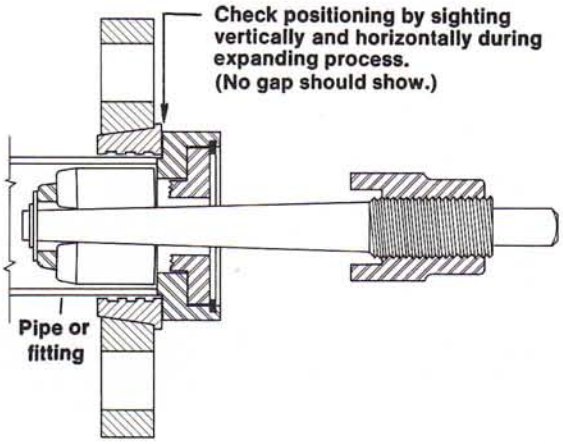


Fig. 5

STEP #4

Re-insert expander and turn till snug tight.

Re-insert expander, then turn mandrel clockwise until "feel" is the same as it was when snug tight was reached previously.

Loosen thumbscrew. Turn stop collar until it contacts thrust collar.

Loosen thumbscrew and turn stop collar clockwise until it firmly contacts back of thrust collar, as shown by dotted lines in Fig. #6.

Back off stop collar 5 turns. Locate keyway and tighten thumbscrew.

Using thumbscrew position as a guide, back off stop collar by turning it counter-clockwise 5 turns. Continue turning stop collar until thumbscrew lines up with keyway, then tighten. This will result in a fraction of a turn more than the required 5 turns.

Stop collar is now in position shown by solid lines in Fig. #6. E designation illustrates distance from back of thrust collar.

Turn clockwise until stop collar contacts thrust collar.

Using proper size wrench for pipe size being expanded, turn mandrel clockwise until stop collar contacts back of thrust collar. Additional lubrication prior to contact is helpful.

Turn additional six revolutions.

Again, using thumbscrew as a guide, turn mandrel six complete revolutions to smooth expanded area. This completes the expansion.

Check expanded area visually.

Remove expander by turning counter-clockwise. Clean lubricant from I.D. of expanded joint and examine visually. Expanded area should be uniformly smooth with a bright burnished finish completely around I.D. with a slightly detectable enlargement of the I.D. ending just beyond the thickness of the insert.

To align bolt holes, simply loosen carbon steel flange from insert by tapping with a soft faced hammer at several points until flange loosens and can be rotated to proper bolt-up position.

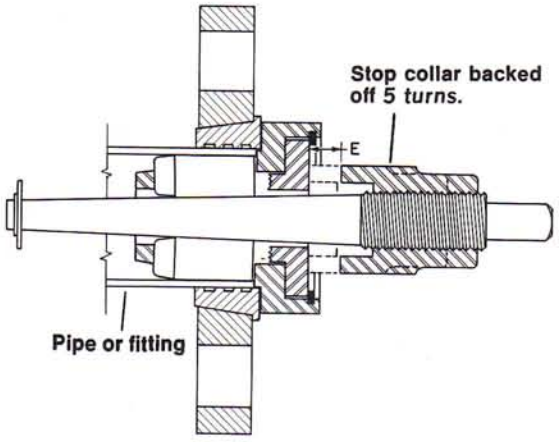
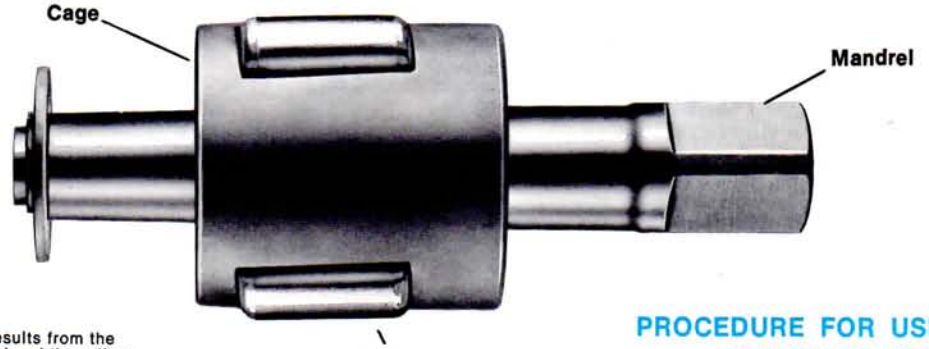


Fig. 6

Speedline® STANDARD EXPANDER Designed for Tapered Expanding

For Assembly of Speedline Fittings and T/D Insert Flanges



Tapered expanding results from the mandrel being tapered and the rollers having parallel sides.

This economical type expander has been used since the Tangential Design concept was first introduced.

While it does not have many of the advantages now available in the newer, more versatile Speedline Rol-Tite Expander, it is still preferred by many satisfied customers.

The design provides ample clearance between the end of the mandrel and the inside of any Speedline Fitting on which Speedline T/D Insert Flanges or Type PE Unions are being expanded.

The only other tools required for expanding are a bench vise or pipe vise and ordinary wrenches of open end, box end, adjustable or socket and ratchet types.

A separate expander is required for each pipe size and for each pipe schedule (wall thickness) except that the 6" size will do both Schedules 5 and 10 with the same mandrel (6" Schedule 40 requires a separate tool).

STANDARD EXPANDER STOCKS

Pipe sizes available

½" ¾" 1" 1¼" 1½" 2" 2½" 3" 4" 6"

Pipe schedules available

Schedule 5 Schedule 10 Schedule 40

WHEN ORDERING SPECIFY

- ☐ STANDARD EXPANDER
- ☐ PIPE SIZE
- ☐ PIPE SCHEDULE

Replacement mandrels, cages, and sets of rollers are available. Schedule 80 Expanders available on special order.

NOTE: Use of this standard expander requires a higher degree of skill than the Rol-Tite expander to attain the proper technique that insures leak-tight joints. Our previous experience has established that the use of torque data is of little significance in obtaining a good expansion because of variables such as hardness of different metals, dimensional tolerances, operator's skill, etc. Development of technique, feel, visual examination and testing offer better determining guides.

PROCEDURE FOR USING SPEEDLINE STANDARD EXPANDERS

1. Cut pipe square and deburr.

   Remove any excessive O.D. or I.D. weld bead on pipe by grinding, being careful to conform to curvature of pipe.
   Clean O.D. and I.D. of pipe or Speedline Fitting and insert serrations.

   Expander must be kept clean, free from dirt, grit or abrasive matter and be well lubricated during use.

2. Hold flange in bench vise and put pipe or fitting into insert. Or hold pipe or fitting in pipe vise and slip flange over end.

3. Position pipe or fitting so that end is recessed about 1/32" from gasket face (recheck during step #4).

4. Slide cage to extreme small end of mandrel. Insert cage into the pipe or fitting, just past rounded end of the rollers. Hold cage in this position and push mandrel in, hand tight. Using wrench, turn mandrel clockwise (as operator faces flange) until the front end of the rollers has travelled to the back of the insert.

5. It may be necessary to repeat step #4 several times to complete expansion.

6. On the last step #4 turn mandrel back and forth several times through about ¾ of a revolution to "iron out" the expanded area.

7. Clean lubrication from I.D. of expanded area and examine visually. Expanded area should have a bright burnished finish extending just beyond thickness of insert. Feel I.D. at this point for a detectable change in I.D. The expanded area should be relatively free from longitudinal ridges caused by the leading roller. If not, repeat step #6.

8. Check to make sure pipe or fitting end does not protrude beyond gasket face of insert. If it does, carefully file flush without scoring insert face.

9. Bolt holes may be aligned by tapping carbon steel flange with soft faced hammer at several spots to loosen from insert. Rotate flange to proper bolt-up position.

Speedline®

BELLED END PIPE FITTINGS

Designed to expedite socket assembly of process piping.

STAINLESS STEELS

Types 304L, 316L, Alloy 20Cb-3

NICKEL 200, **MONEL** 400

Other alloys on application.

- **EASY TO FIT-UP**
- **CAN BE WELDED**
- **CAN BE BRAZED OR SOLDERED**
- **REDUCE INSTALLATION COSTS**

Speedline Belled End Fittings solve many of the problems frequently encountered during field assembly of process piping, especially with light wall material. Squareness of pipe ends and concentricity of pipe are not as critical as with other assembly methods. Belled End Fittings, however, can be used only for socket type connections.

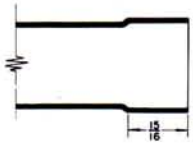
For more fitting and assembly versatility refer to previous data pages for Speedline Tangential fittings that can be butt welded, flanged or socket connected.

Easy fit-up and true alignment is assured with precision formed, dimensionally accurate Speedline Belled End Fittings. Square cut pipe readily fits into the carefully sized sockets to simplify welding or brazing joining procedures.

No matter which joining method is employed, Speedline accuracy does make the job easier and thus assembly costs can be held to an absolute minimum.

SOCKET DETAILS

Common to all fittings except Reducers



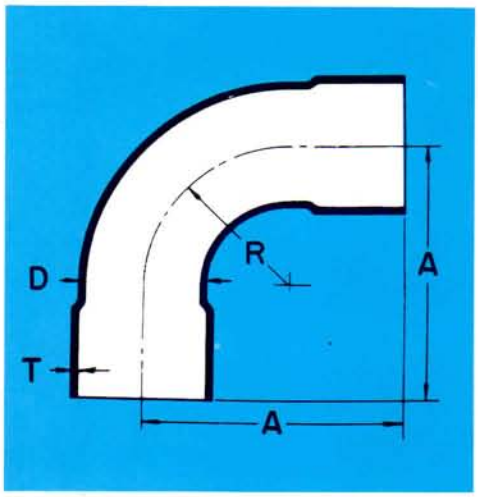
Socket depth tolerance: $\pm 1/16''$

Socket details for reducers are listed on Eccentric and Concentric data pages.

Speedline®

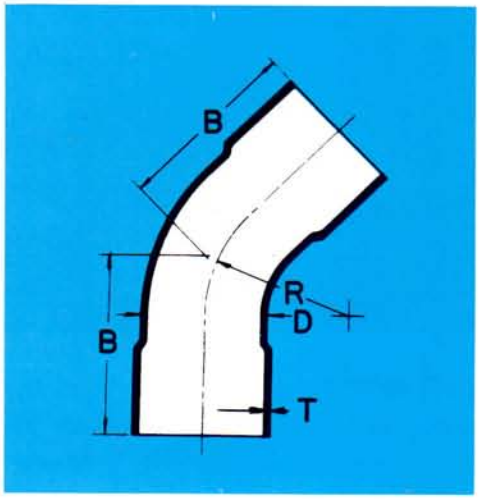
BELLED END PIPE FITTINGS

90° ELBOW



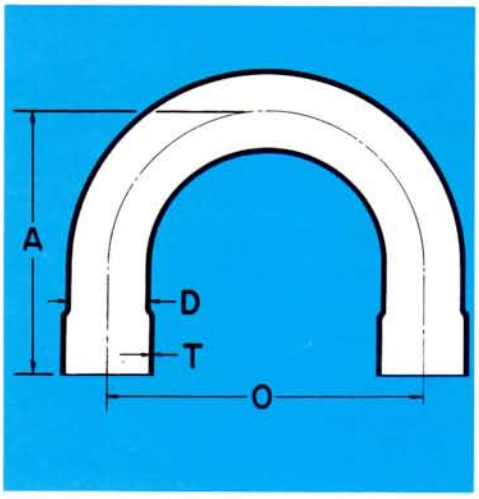
Pipe Size I.P.S.	O.D. D	Radius R	Center to End A	Sch 5S Wall T	Sch 10S Wall T
½	.840	1½	2 5/16	.065	.083
¾	1.050	1⅛	2 9/16	.065	.083
1	1.315	1½	2 13/16	.065	.109
1¼	1.660	1⅞	3 1/16	.065	.109
1½	1.900	2¼	3 7/16	.065	.109
2	2.375	3	4 3/16	.065	.109
2½	2.875	3¾	4 15/16	.083	.120
3	3.500	4½	6 7/16	.083	.120
4	4.500	6	8 3/16	.083	.120
6	6.625	9	11 3/16	.109	.134

45° ELBOW



Pipe Size I.P.S.	O.D. D	Radius R	Center to End B	Sch 5S Wall T	Sch 10S Wall T
½	.840	1½	1 7/16	.065	.083
¾	1.050	1⅛	1⅞	.065	.083
1	1.315	1½	1 15/16	.065	.109
1¼	1.660	1⅞	1 15/16	.065	.109
1½	1.900	2¼	2⅛	.065	.109
2	2.375	3	2 7/16	.065	.109
2½	2.875	3¾	2¾	.083	.120
3	3.500	4½	3 13/16	.083	.120
4	4.500	6	4 11/16	.083	.120
6	6.625	9	5 15/16	.109	.134

180° RETURN BEND



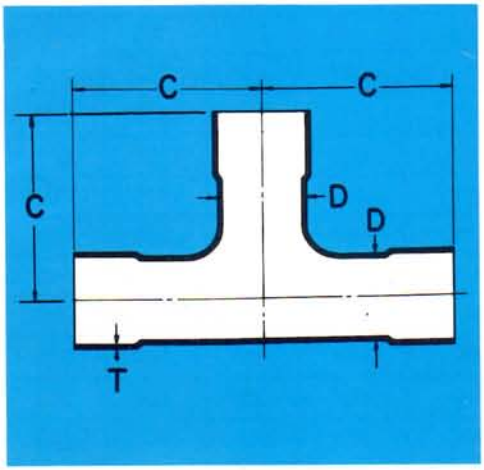
Pipe Size I.P.S.	O.D. D	Center to Center O	Center to End A	Sch 5S Wall T	Sch 10S Wall T
½	.840	3⅝	2 5/16	.065	.083
¾	1.050	4	2 9/16	.065	.083
1	1.315	5	2 13/16	.065	.109
1¼	1.660	5½	3 1/16	.065	.109
1½	1.900	6	3 7/16	.065	.109
2	2.375	8	5 7/16	.065	.109
2½	2.875	9	4 15/16	.083	.120
3	3.500	9	6 7/16	.083	.120
4	4.500	12	8 3/16	.083	.120
6	6.625	18	11 3/16	.109	.134

See applicable footnotes pages 9, 10, 11.

Speedline®

BELLED END PIPE FITTINGS

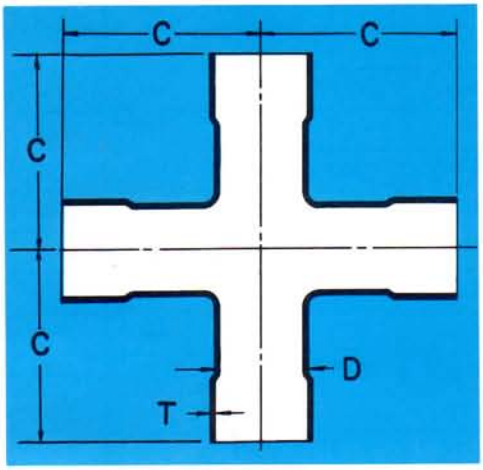
TEE



Pipe Size I.P.S.	O.D. D	Center to End C	Sch 5S Wall T	Sch 10S Wall T
½	.840	2 5/16	.065	.083
¾	1.050	2 9/16	.065	.083
1	1.315	2 13/16	.065	.109
1¼	1.660	3 1/16	.065	.109
1½	1.900	3 7/16	.065	.109
2	2.375	4 3/16	.065	.109
2½	2.875	4 15/16	.083	.120
3	3.500	4 15/16	.083	.120
4	4.500	5 11/16	.083	.120
6	6.625	7 13/16	.109	.134

Speedline Reducing Tee, page 42.

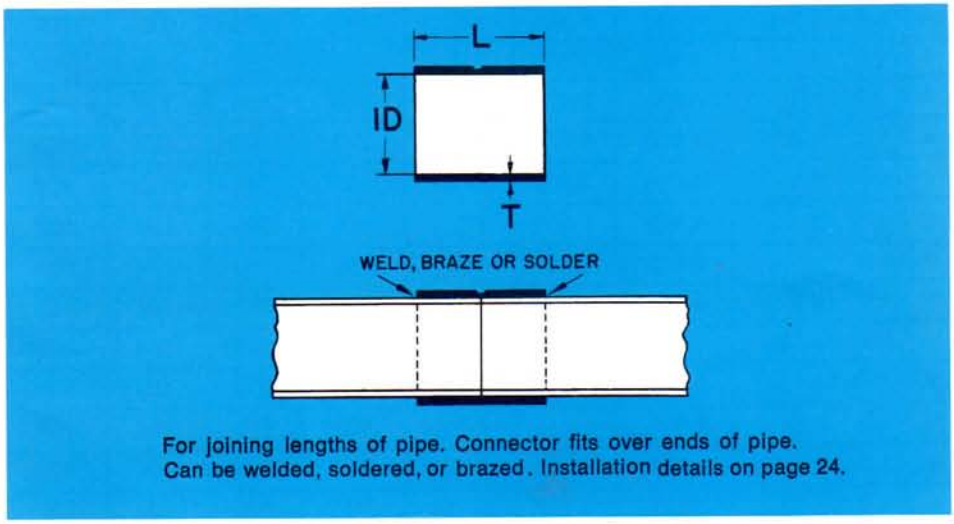
CROSS



Pipe Size I.P.S.	O.D. D	Center to End C	Sch 5S Wall T	Sch 10S Wall T
½	.840	2 5/16	.065	.083
¾	1.050	2 9/16	.065	.083
1	1.315	2 13/16	.065	.109
1¼	1.660	3 1/16	.065	.109
1½	1.900	3 7/16	.065	.109
2	2.375	4 3/16	.065	.109
2½	2.875	4 15/16	.083	.120
3	3.500	4 15/16	.083	.120
4	4.500	5 11/16	.083	.120
6	6.625	7 13/16	.109	.134

Speedline Reducing Cross is also available.

ALIGNING CONNECTOR



For joining lengths of pipe. Connector fits over ends of pipe.
Can be welded, soldered, or brazed. Installation details on page 24.

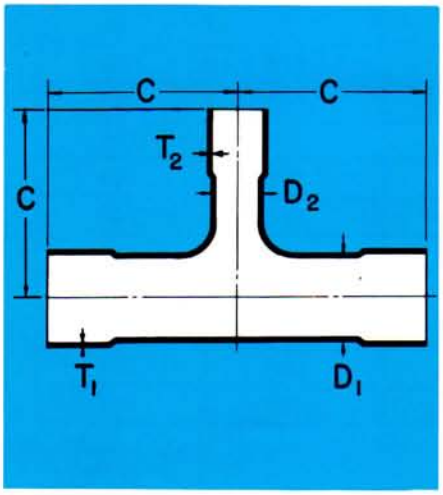
INSIDE DIA. (Nominal) I.D.	LENGTH L	WALL* T
.840	1 1/8	.083
1.050	1 1/8	.083
1.315	1¼	.109
1.660	1¼	.109
1.900	1 3/8	.109
2.375	1 3/8	.109
2.875	1 5/8	.120
3.500	1¾	.120
4.500	1¾	.120
6.625	2	.134

* Standard stocks to be used with Sch. 5 or 10 piping.

See applicable footnotes pages 12, 13, 15.

Speedline®

BELLED END PIPE FITTINGS



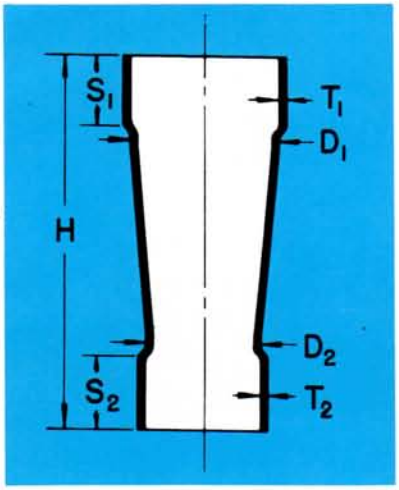
REDUCING TEE

Pipe Size I.P.S.	O.D. Run D_1	O.D. Outlet D_2	Center to End C	Sch 5S Wall T_1	Sch 5S Wall T_2	Sch 10S Wall T_1	Sch 10S Wall T_2
¾ x ¾ x ½	1.050	.840	2 9/16	.065	.065	.083	.083
1 x 1 x ½	1.315	.840	2 13/16	.065	.065	.109	.083
1 x 1 x ¾	1.315	1.050	2 13/16	.065	.065	.109	.083
1¼ x 1¼ x ½	1.660	.840	3 1/16	.065	.065	.109	.083
1¼ x 1¼ x ¾	1.660	1.050	3 1/16	.065	.065	.109	.083
1¼ x 1¼ x 1	1.660	1.315	3 1/16	.065	.065	.109	.109
1½ x 1½ x ½	1.900	.840	3 7/16	.065	.065	.109	.083
1½ x 1½ x ¾	1.900	1.050	3 7/16	.065	.065	.109	.083
1½ x 1½ x 1	1.900	1.315	3 7/16	.065	.065	.109	.109
1½ x 1½ x 1¼	1.900	1.660	3 7/16	.065	.065	.109	.109
2 x 2 x ½	2.375	.840	4 3/16	.065	.065	.109	.083
2 x 2 x ¾	2.375	1.050	4 3/16	.065	.065	.109	.083
2 x 2 x 1	2.375	1.315	4 3/16	.065	.065	.109	.109
2 x 2 x 1¼	2.375	1.660	4 3/16	.065	.065	.109	.109
2 x 2 x 1½	2.375	1.900	4 3/16	.065	.065	.109	.109
2½ x 2½ x ½	2.875	.840	4 15/16	.083	.065	.120	.083
2½ x 2½ x ¾	2.875	1.050	4 15/16	.083	.065	.120	.083
2½ x 2½ x 1	2.875	1.315	4 15/16	.083	.065	.120	.109
2½ x 2½ x 1¼	2.875	1.660	4 15/16	.083	.065	.120	.109
2½ x 2½ x 1½	2.875	1.900	4 15/16	.083	.065	.120	.109
2½ x 2½ x 2	2.875	2.375	4 15/16	.083	.065	.120	.109
3 x 3 x ½	3.500	.840	4 15/16	.083	.065	.120	.083
3 x 3 x ¾	3.500	1.050	4 15/16	.083	.065	.120	.083
3 x 3 x 1	3.500	1.315	4 15/16	.083	.065	.120	.109
3 x 3 x 1¼	3.500	1.660	4 15/16	.083	.065	.120	.109
3 x 3 x 1½	3.500	1.900	4 15/16	.083	.065	.120	.109
3 x 3 x 2	3.500	2.375	4 15/16	.083	.065	.120	.109
3 x 3 x 2½	3.500	2.875	4 15/16	.083	.083	.120	.120
4 x 4 x ½	4.500	.840	5 11/16	.083	.065	.120	.083
4 x 4 x ¾	4.500	1.050	5 11/16	.083	.065	.120	.083
4 x 4 x 1	4.500	1.315	5 11/16	.083	.065	.120	.109
4 x 4 x 1¼	4.500	1.660	5 11/16	.083	.065	.120	.109
4 x 4 x 1½	4.500	1.900	5 11/16	.083	.065	.120	.109
4 x 4 x 2	4.500	2.375	5 11/16	.083	.065	.120	.109
4 x 4 x 2½	4.500	2.875	5 11/16	.083	.083	.120	.120
4 x 4 x 3	4.500	3.500	5 11/16	.083	.083	.120	.120
6 x 6 x ½	6.625	.840	7 13/16	.109	.065	.134	.083
6 x 6 x ¾	6.625	1.050	7 13/16	.109	.065	.134	.109
6 x 6 x 1	6.625	1.315	7 13/16	.109	.065	.134	.109
6 x 6 x 1¼	6.625	1.660	7 13/16	.109	.065	.134	.109
6 x 6 x 1½	6.625	1.900	7 13/16	.109	.065	.134	.109
6 x 6 x 2	6.625	2.375	7 13/16	.109	.065	.134	.109
6 x 6 x 2½	6.625	2.875	7 13/16	.109	.083	.134	.120
6 x 6 x 3	6.625	3.500	7 13/16	.109	.083	.134	.120
6 x 6 x 4	6.625	4.500	7 13/16	.109	.083	.134	.120

See applicable footnotes pages 14 and 15.

Speedline®

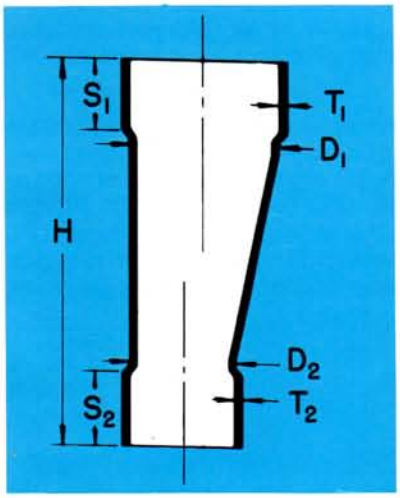
BELLED END PIPE FITTINGS



CONCENTRIC REDUCER

Pipe Size I.P.S.	O.D. Large End D_1	O.D. Small End D_2	Length H	Socket Depth Large End S_1*	Socket Depth Small End S_2*	Sch 5S Wall T_1	Sch 5S Wall T_2	Sch 10S Wall T_1	Sch 10S Wall T_2
¾ x ½	1.050	.840	3⅝	⅝	½	.065	.065	.083	.083
1 x ½	1.315	.840	3⅝	⅝	½	.065	.065	.109	.083
1 x ¾	1.315	1.050	3⅝	⅝	⅝	.065	.065	.109	.083
1¼ x ¾	1.660	1.050	3⅝	⅝	⅝	.065	.065	.109	.083
1¼ x 1	1.660	1.315	3⅝	⅝	⅝	.065	.065	.109	.109
1½ x ½	1.900	.840	3⅝	⅝	½	.065	.065	.109	.083
1½ x ¾	1.900	1.050	3⅝	⅝	⅝	.065	.065	.109	.083
1½ x 1	1.900	1.315	3⅝	⅝	⅝	.065	.065	.109	.109
1½ x 1¼	1.900	1.660	3⅝	⅝	⅝	.065	.065	.109	.109
2 x ½	2.375	.840	3⅝	¾	⅝	.065	.065	.109	.083
2 x ¾	2.375	1.050	3⅝	¾	⅝	.065	.065	.109	.083
2 x 1	2.375	1.315	3⅝	¾	⅝	.065	.065	.109	.109
2 x 1¼	2.375	1.660	3⅝	¾	⅝	.065	.065	.109	.109
2 x 1½	2.375	1.900	3⅝	¾	⅝	.065	.065	.109	.109
2½ x 1	2.875	1.315	5⅛	¾	⅝	.083	.065	.120	.109
2½ x 1¼	2.875	1.660	5⅛	¾	⅝	.083	.065	.120	.109
2½ x 1½	2.875	1.900	5⅛	¾	¾	.083	.065	.120	.109
2½ x 2	2.875	2.375	5⅛	¾	⅝	.083	.065	.120	.109
3 x 1	3.500	1.315	5⅛	¾	⅝	.083	.065	.120	.109
3 x 1¼	3.500	1.660	5⅛	¾	⅝	.083	.065	.120	.109
3 x 1½	3.500	1.900	5⅛	¾	⅝	.083	.065	.120	.109
3 x 2	3.500	2.375	5⅛	¾	¾	.083	.065	.120	.109
3 x 2½	3.500	2.875	5⅛	¾	¾	.083	.083	.120	.120
4 x 2	4.500	2.375	5⅛	¾	¾	.083	.065	.120	.109
4 x 2½	4.500	2.875	5⅛	¾	¾	.083	.083	.120	.120
4 x 3	4.500	3.500	5⅛	¾	¾	.083	.083	.120	.120
6 x 3	6.625	3.500	8⅞	¾	¾	.109	.083	.134	.120
6 x 4	6.625	4.500	8⅞	¾	¾	.109	.083	.134	.120

* Plus/Minus 1/16"



ECCENTRIC REDUCER

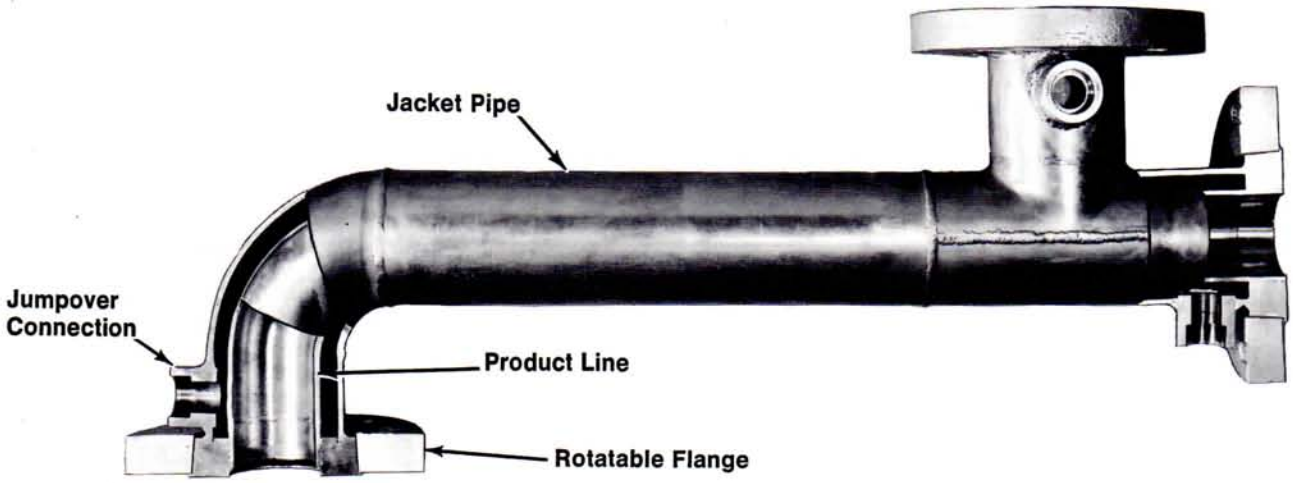
Pipe Size I.P.S.	O.D. Large End D_1	O.D. Small End D_2	Length H	Socket Depth Large End S_1*	Socket Depth Small End S_2*	Sch 5S Wall T_1	Sch 5S Wall T_2	Sch 10S Wall T_1	Sch 10S Wall T_2
¾ x ½	1.050	.840	3⅝	⅝	½	.065	.065	.083	.083
1 x ½	1.315	.840	3⅝	⅝	½	.065	.065	.109	.083
1 x ¾	1.315	1.050	3⅝	⅝	⅝	.065	.065	.109	.083
1¼ x 1	1.660	1.315	3⅝	⅝	⅝	.065	.065	.109	.109
1½ x ¾	1.900	1.050	3⅝	⅝	⅝	.065	.065	.109	.083
1½ x 1	1.900	1.315	3⅝	⅝	⅝	.065	.065	.109	.109
1½ x 1¼	1.900	1.660	3⅝	⅝	⅝	.065	.065	.109	.109
2 x 1	2.375	1.315	3⅝	¾	⅝	.065	.065	.109	.109
2 x 1¼	2.375	1.660	3⅝	¾	⅝	.065	.065	.109	.109
2 x 1½	2.375	1.900	3⅝	¾	⅝	.065	.065	.109	.109
2½ x 2	2.875	2.375	5⅛	¾	¾	.083	.065	.120	.109
3 x 2	3.500	2.375	5⅛	¾	¾	.083	.065	.120	.109
3 x 2½	3.500	2.875	5⅛	¾	¾	.083	.083	.120	.120
4 x 2½	4.500	2.875	5⅛	¾	¾	.083	.083	.120	.120
4 x 3	4.500	3.500	5⅛	¾	¾	.083	.083	.120	.120
6 x 4	6.625	4.500	8⅞	¾	¾	.109	.083	.134	.120

* Plus/Minus 1/16"

See applicable footnotes pages 16, 17, 18.

Speedline® T/D® JACKETED PIPING

A VERSATILE PIPING SYSTEM FOR CONTROLLING PRODUCT TEMPERATURE IN PROCESS PIPELINES



The Speedline T/D Jacketed Piping system was developed to simplify selection and application of jacketed pipe and fittings by the design engineer.

Important economies can be initiated by the engineer when Speedline advantages are considered during primary design stage.

Competent engineering judgment by the client must first establish proper sizes and grades of materials that will comply with the allowable working stresses at design temperature.

It is then a simple matter to select the preferred Speedline components or assemblies that will meet all design requirements.

SPEEDLINE JACKETED DESIGN SIMPLIFIES INSTALLATION, PROVIDES BETTER TEMPERATURE CONTROL

Speedline Jacketed Piping and Jacketed Fittings consist of a corrosion resistant metal inner (or core) pipe, often referred to as the product line, within a larger (jacket) pipe flanged on the ends. The jacketed pipe and fittings have inlet and outlet connections so that heat transfer medium can flow into, through and out of the space between the two pipes (annulus).

When the jacketed system does not require corrosion resistant metal for the inner (core) pipe, carbon steel may be specified for both core and jacket.

Speedline components or assemblies can simplify installation and improve the results of all jacketed systems, accomplishing a degree of efficiency plus economy not possible otherwise.

The controlled temperatures possible with a Speedline system permits transfer of products in a free flowing fluid state that would ordinarily be sticky, semi-solid or solid at atmospheric temperature. The installation can provide temperature control for the entire pipeline or a specific portion of the system. Product temperature can be maintained either above or below normal surrounding (ambient) temperature, indoors or outdoors.

SPEEDLINE JACKETED PIPING UTILIZES THE HEAT EXCHANGER PRINCIPLE TO CONTROL PRODUCT TEMPERATURE IN THE PIPELINE.

When the product temperature must be maintained above ambient, the product flowing through the inner pipe extracts heat from the heat transfer medium in the annulus.

If product temperature must be kept below ambient, the heat transfer medium in the annulus extracts heat from the product until proper temperature is achieved.

HEAT TRANSFER MEDIA

Steam is most commonly used and is usually readily available. Steam disadvantage is its rapidly rising pressure at relatively small temperature increases.

Any of the commercially available heat transfer compositions that will accomplish the desired results may be used if the system has been designed to handle the medium selected. The design engineer should evaluate all factors involved in the installation before selecting the heat transfer medium.

HEATING MEDIA

- **Hot water**
- **Hot Oil**
- **Synthetic gases**
- **Saturated steam**

COOLING MEDIA

- **Cold water**
- **Ammonia**

Plus various readily available trade-named products developed and marketed by nationally known producers.

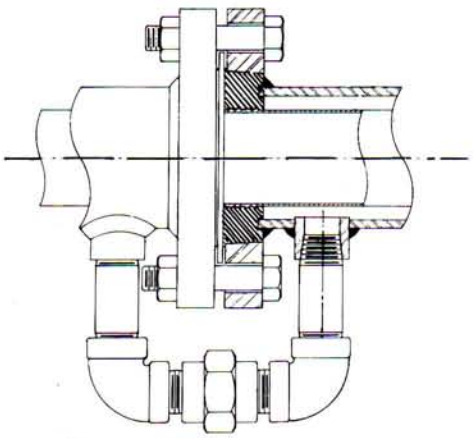
HEAT TRANSFER MEDIUM IS CONVEYED FROM UNIT TO UNIT BY JUMPOVER ARRANGEMENT

Since each individual jacketed assembly or jacketed fitting in the system has an isolated annulus, inlets and outlets are located as specified so that jumpovers can be readily assembled in the field when the piping is being erected.

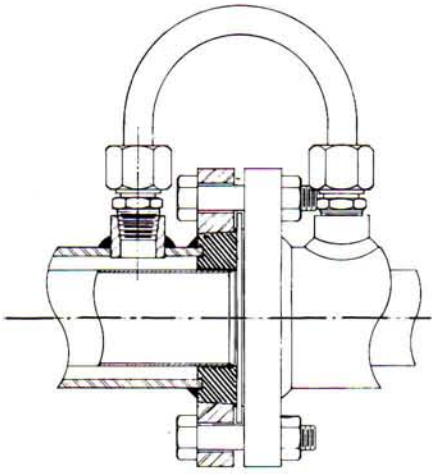
These external jumpovers provide for uniform flow of heat transfer medium throughout the system.

Ordinary threaded pipe and fittings or O.D. tubing with hydraulic or compression type fittings may be used. Jumpovers are not normally supplied by Speedline but rather by the job site installer.

External jumpovers effectively prevent any contamination of the product by the heat transfer medium.



Screwed Fitting Arrangement



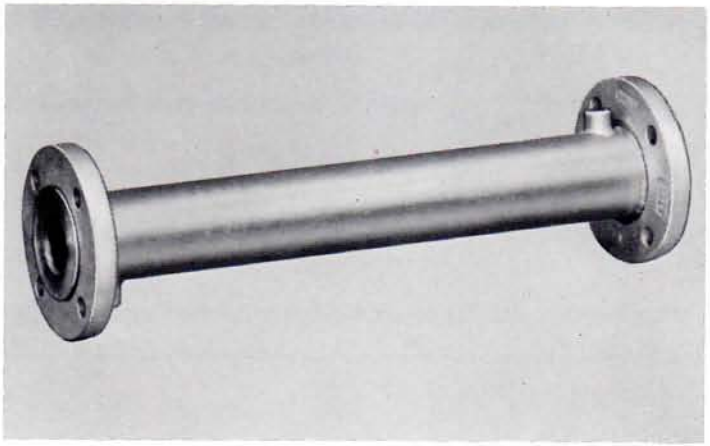
Compression Fitting Arrangement

Speedline®

JACKETED PIPE

FABRICATED TO LENGTH SPECIFIED

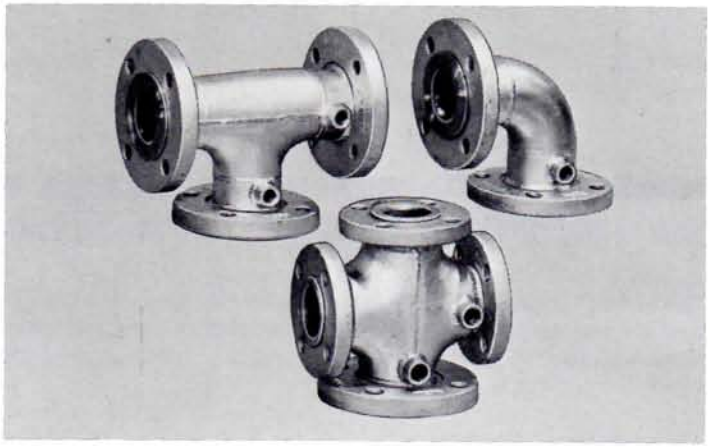
Straight lengths may be ordered up to 40′ long or subject to shipping limitations. Spacers are used to maintain uniform annulus area and are located as required or as specified. All ends are flanged with easy to install Speedline T/D Jacketed Piping Insert Flanges.



Speedline®

JACKETED FITTINGS

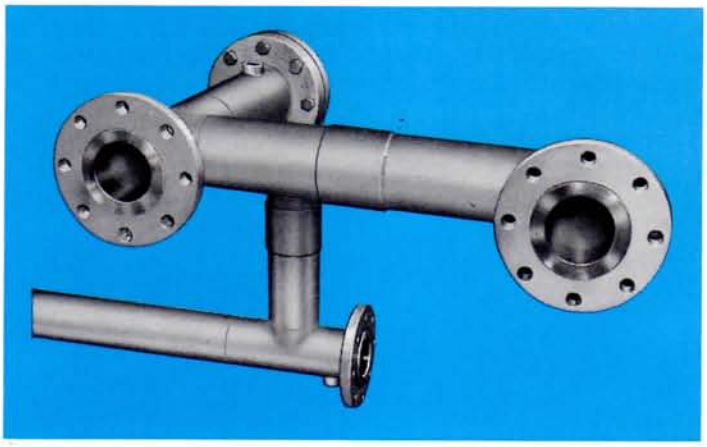
Provides a complete unit, ready to install. Tangential design of the Speedline Fittings used for the product line reduces number of welds and Speedline T/D Jacketed Piping Insert Flanges eliminate alignment problems.

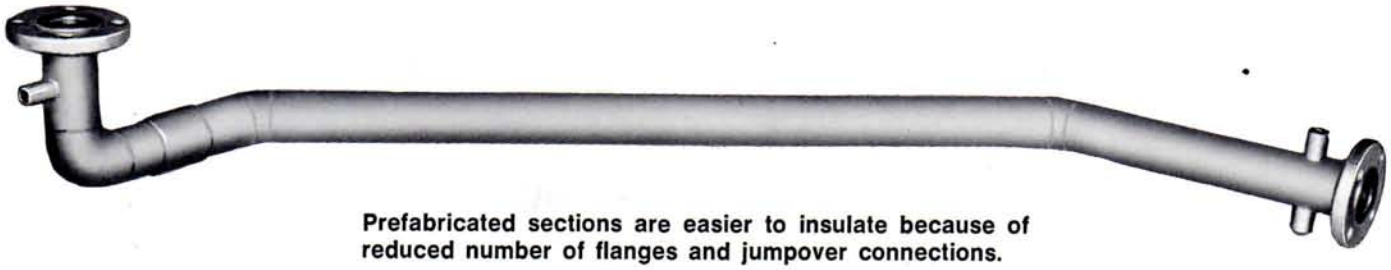


Speedline®

JACKETED ASSEMBLIES

Important savings in material costs and installation time result when prefabricated sections are specified. Layout of piping required or, better yet, an isometric sketch is all that's needed to formulate a cost saving proposal for any installation.



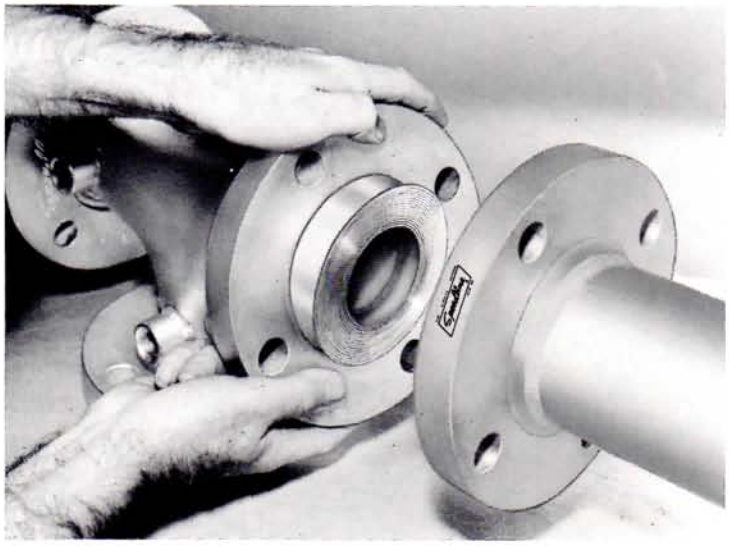


Prefabricated sections are easier to insulate because of reduced number of flanges and jumpover connections.

Speedline® SPECIAL JACKETED FITTINGS

The most complex jacketed piping requirements can be more readily accomplished with a Speedline system. Tangential Fittings and T/D Jacketed Piping Insert Flanges provide an extra measure of design versatility which is more adaptable to difficult processing situations.

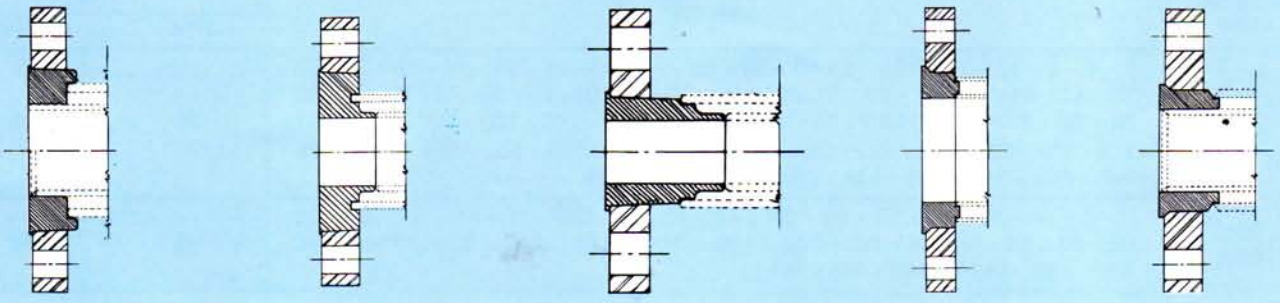
Speedline® T/D JACKETED PIPING INSERT FLANGE



Insert design insures positive positioning of inner pipe and jacket. And the rotatable flange eliminates bolt hole alignment problems. Flanges may be ordered separately for shop or field fabrication.

VARIATIONS OF JACKETED PIPING INSERT FLANGES PRODUCED FOR CUSTOMER APPLICATIONS

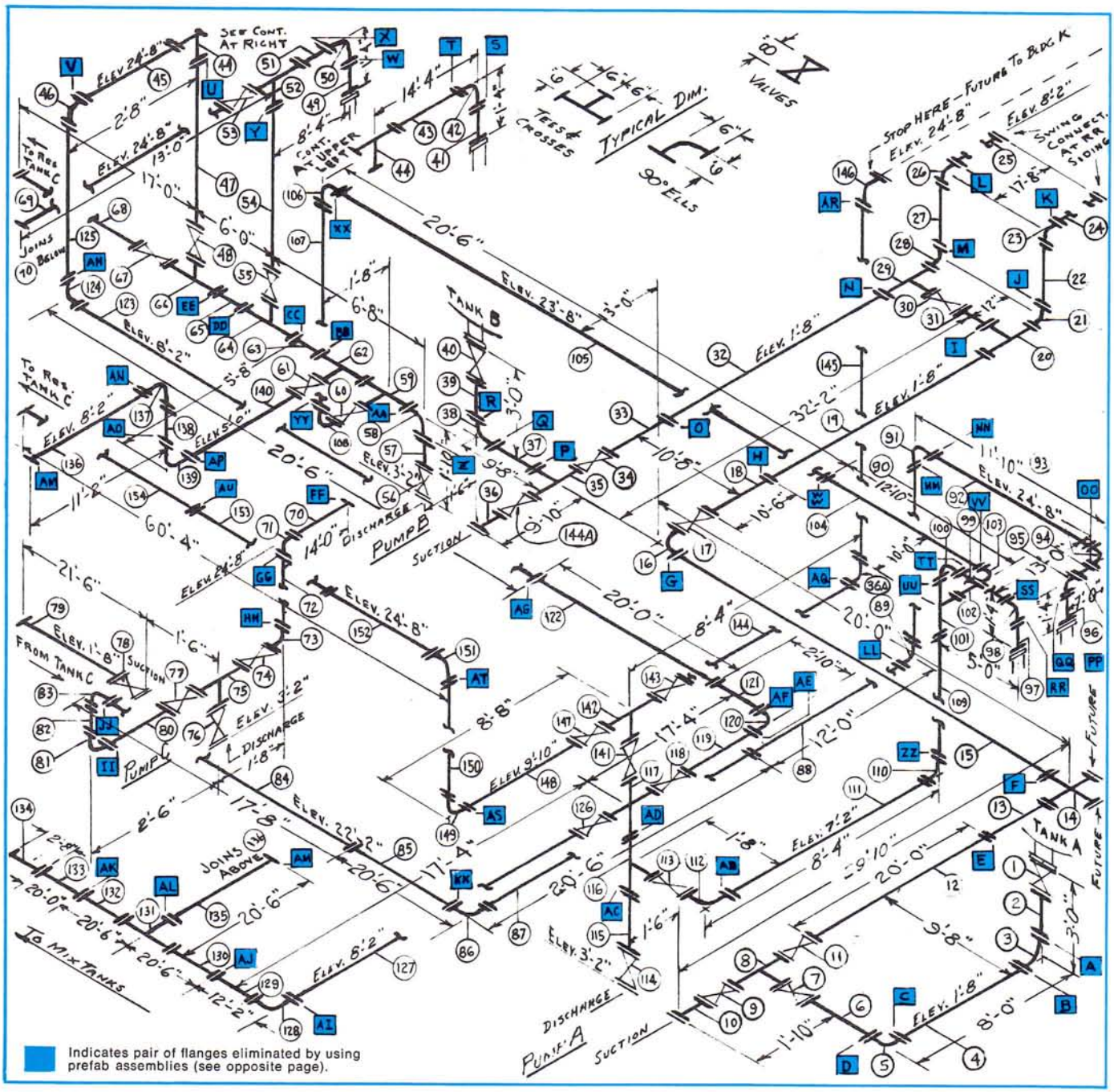
Insert design can be modified to suit individual requirements.



THESE ISOMETRIC LAYOUTS ILLUSTRATE THE MANY ADVANTAGES

INDIVIDUAL COMPONENTS INCREASE MATERIAL REQUIREMENTS AND LABOR COSTS

See opposite page for this same layout using assemblies.



Indicates pair of flanges eliminated by using prefab assemblies (see opposite page).

BILL OF MATERIAL — JACKETED COMPONENTS

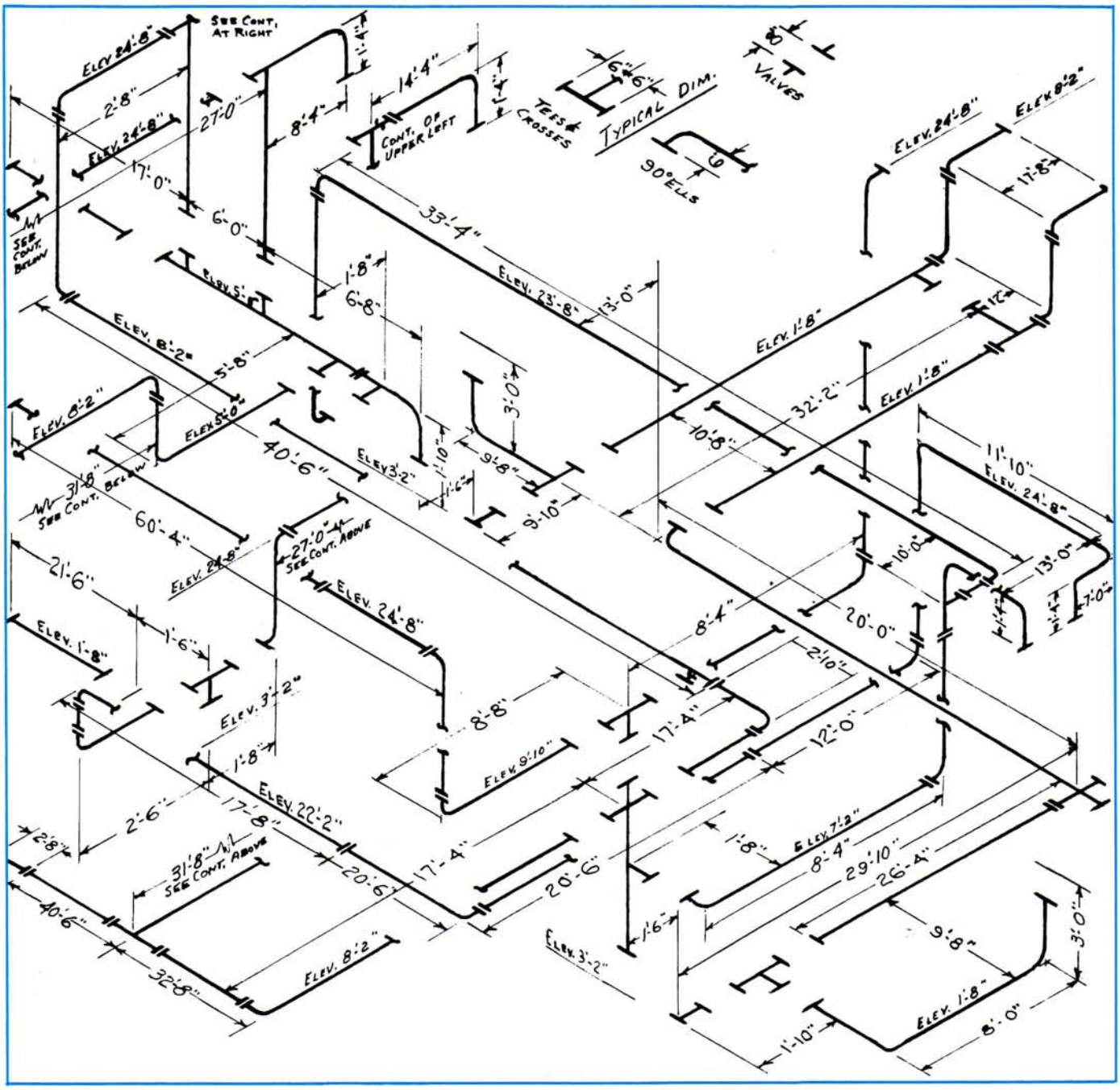
JACKETED ITEMS	ITEM NO.	PIECES	
		ITEM	FLANGES
Straight Pipe	2 - 4 - 6 - 10 - 12 - 13 - 15 - 18 - 19 - 22 - 24 - 25 - 27 - 31 - 32 - 33 - 36 - 37 39 - 41 - 43 - 45 - 47 - 49 - 51 - 54 - 57 - 63 - 65 - 68 - 69 - 70 - 72 - 79 - 80 - 82 84 - 85 - 87 - 88 - 90 - 92 - 94 - 96 - 97 - 99 - 102 - 104 - 105 - 107 - 109 - 111 115 - 119 - 121 - 122 - 123 - 125 - 127 - 129 - 130 - 132 - 133 - 134 - 135 - 136 138 - 140 - 144 - 145 - 148 - 150 - 152 - 153 - 154	75	150
90° Ells	3 - 5 - 16 - 21 - 23 - 26 - 28 - 38 - 42 - 46 - 50 - 58 - 71 - 73 - 81 - 83 - 86 89 - 91 - 93 - 95 - 98 - 100 - 103 - 106 - 108 - 110 - 112 - 120 - 124 - 128 137 - 139 - 144A - 146 - 149 - 151	37	74
Tees— Crosses	8 - 14 - 20 - 29 - 35 - 44 - 52 - 59 - 62 - 64 - 66 - 75 - 101 - 116 - 117 - 131 - 142	17	53
	TOTALS	129	277

Valves were not included in tabulations because count would be same in either case.

OF SPECIFYING Speedline® PREFABRICATED JACKETED ASSEMBLIES.

PREFABRICATED ASSEMBLIES SAVE MATERIAL AND REDUCE LABOR COSTS

Jacketed items and flange requirements can be cut in half.



BILL OF MATERIAL PREFAB ASSEMBLIES

JACKETED ITEMS	PIECES	
	ITEM	FLANGES
Pipe	18	36
Tees	3	9
Prefab Assemblies	36	88
TOTALS	57	133

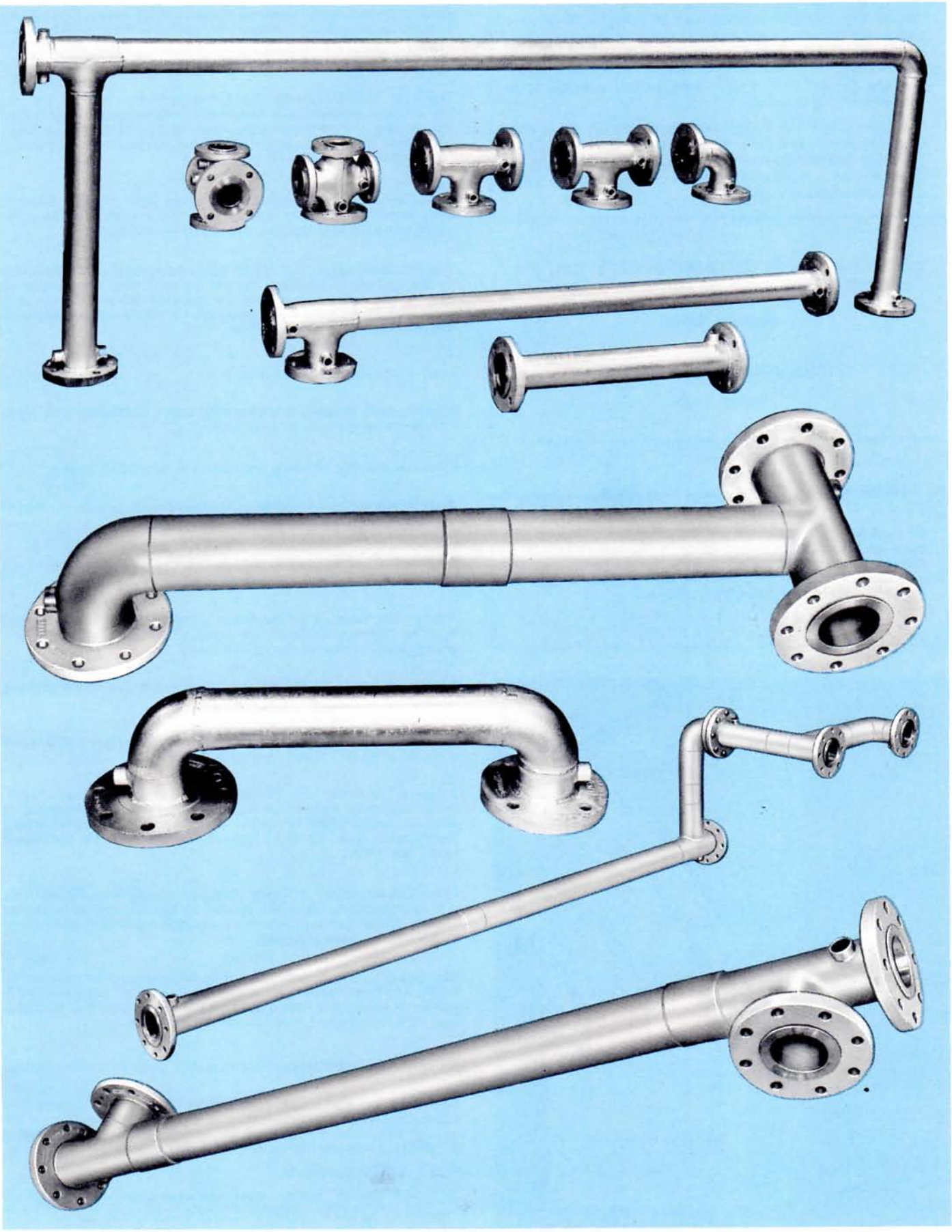
PREFAB ECONOMIES

MATERIAL SAVINGS	LABOR SAVINGS
144 Flanges	144 fewer flanges to weld
144 Half Couplings	144 fewer couplings to weld
144 Tubing Connectors	72 fewer units to erect
100/150 Ft. Tubing	72 fewer jumpover to form and assemble

Plus insulation savings because of fewer obstructions

Typical T/D Jacketed Piping Assemblies Custom

Produced for Various Customer Applications.



Speedline® T/D JACKETED PIPING

MATERIALS OF CONSTRUCTION

Almost any corrosion problem can be handled since customer can specify proper metal analysis for the inner pipe and the flange insert which are the components that come in contact with the product. Flange inserts are normally made of Type 316 stainless steel unless another analysis or a different alloy is ordered.

The jacket pipe and fittings are usually carbon steel but stainless steels and other alloys may be specified when required. The flange portion of the T/D Jacketed Piping Insert Flange is made of ductile iron or forged carbon steel unless otherwise specified.

SPEEDLINE JACKETED COMPONENTS CAN BE ORDERED IN ANY TYPE OF METAL.

Stainless Steels

Alloy 20

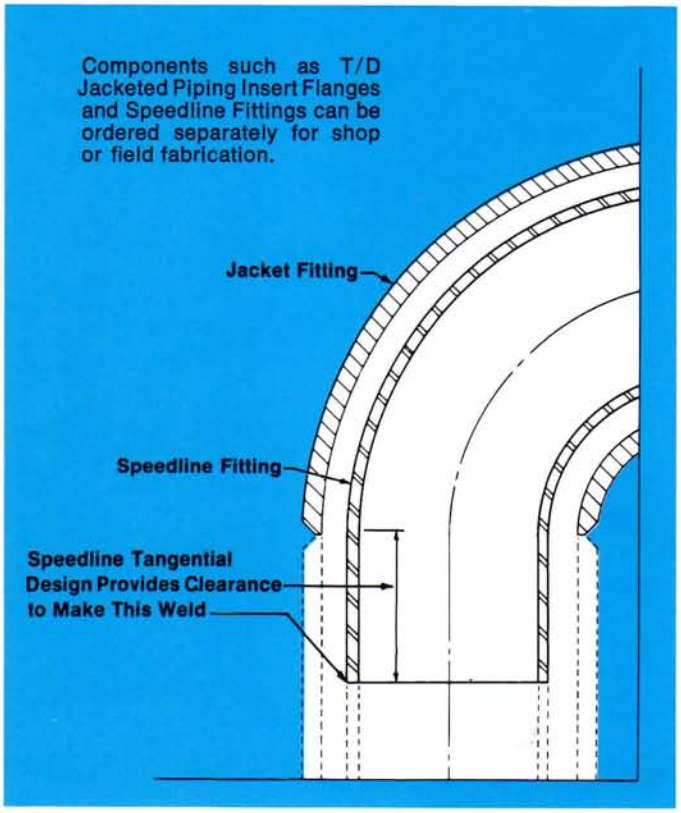
Nickel, Monel, Inconel, Incoloy

Carbon Steel

FORMS AVAILABLE:

Straight sections of completely jacketed pipe • Individual completely jacketed standard fittings • Pre-fabricated completely jacketed assemblies • Individual completely jacketed special fittings • T/D jacketed piping Insert Flanges • Special T/D jacketed piping Insert Flanges.

Components such as T/D Jacketed Piping Insert Flanges and Speedline Fittings can be ordered separately for shop or field fabrication.



The T/D Jacketed Piping Insert Flange is a specially engineered modification of the standard Speedline T/D Insert Flange.[1] It provides a shoulder or a recess on the back of the insert. This insures a sound structural weld between the jacket and insert while aligning the jacket for concentricity with the inner pipe. The patented rotatable flange provides for ease of bolt hole alignment.

•

The T/D Jacketed Piping Insert Flange design insures that the heat transfer medium flows completely from flange to flange within the annulus. Each section is jacketed right up to the flange. Maximum heat transfer capacity is utilized, eliminating troublesome "dead spots" or unjacketed portions.

•

Corrosion resistance is maintained when inner pipe or fitting is expanded into the insert, instead of welded. It eliminates the detriments of a heat affected zone caused by the welding.

•

The process design engineer can take advantage of the flexibility of the Speedline jacketed system by selecting components or assemblies. . . all of which can be installed horizontally or vertically, and which have been designed for maximum compactness where limited space is a problem.

•

Ease of insulating after erection.

•

Lower overall installed and operating costs, consistent with superior performance and product control.

•

Minimum amount of costly maintenance and "shut-downs."

•

Ease of adding to or modifying existing installation for increased capacity or as a result of processing changes.

•

All exposed carbon steel is given a coat of aluminum paint (unless specified otherwise by the customer).

•

The gasket faces of all Speedline jacketed piping are protected prior to shipping. All items are carefully crated, boxed, or otherwise suitably protected during shipment.

•

All items are carefully marked, with customer's pipe line identifying numbers or symbols for ease in erection.

•

All items are carefully inspected during fabrication and upon completion by fully trained supervisory personnel.

•

All items are tested with 100 psig air pressure in annulus. At additional cost other methods of inspection and testing, such as radiographic examination of welds, dye penetrant testing of welds, freon-halide leak detector, hydrostatic, etc. can be performed when specified.

•

Speedline fabricates jacketed piping to comply with the customer's specifications * and the quality of the fabrication complies with the United States of America Standards Institute Specification USAS-B31.3 pressure piping.

•

The jacket pipe is normally schedule 40 seamless carbon steel to ASTM A53 specification. However, when required and specified it can be of almost any corrosion resistant metal. Sch. 5 or 10 stainless steel jacket pipes have frequently been used.

•

All welds cleaned with stainless steel wire brushes or other means.

•

Speedline jacketed piping installations have been in satisfactory continual service for twenty years; an adequate testimonial to quality. Speedline's reputation is unsurpassed in this field and backed by a company continuously in business for over 150 years.

1 See T/D Flange Data Page 29.

* Note:—It properly remains the responsibility of the customer's piping design engineers, to select the proper sizes and grades of materials to handle the customer's process, and that such selections comply with the allowable working stresses at design temperatures and pressures of USAS-B31.3 or other governing codes or laws where applicable.

Speedline® T/D JACKETED PIPING

SUGGESTED ORDERING CONSIDERATIONS

1. Inner Pipe Size—Sch. 5, 10, 40 or 80—type of metal.

2. Jacket Pipe Size—Sch. 5, 10, 40 or 80—type of metal. Normally Sch. 40 Carbon Steel but can be corrosion resistant metal.

3. Flange Size and Rating—150# or 300#, etc. Usually corresponds to jacket pipe size or inner pipe size. Selection often determined by flange size on connecting equipment, pumps, valves, etc.

4. Type of Metal for Insert of T/D Jacketed Piping Insert Flange.

5. Design Pressure and Temperature for both inner pipe and jacket.

6. Face to Face Lengths—For straight jacketed pipe.*

7. Center to Face Dimensions—In all directions for assemblies or special fittings.*

*Normal tolerance ±⅛".

8. Location of Inlets and Outlets—Size, number, type and location of jumpover connections (usually half couplings, same material as jacket, 2 per unit).

9. Type Joint for Inner Pipe or Fitting—Expanded or recessed fillet welded.

10. Other Requirements — Customer specifications, code requirements, heat transfer medium, etc.

11. Drawings — Piping layout or isometric.

RECOMMENDED INNER PIPE AND JACKET PIPE SIZE COMBINATIONS

The fabrication of jacketed elbows is necessarily limited to combinations listed below because of fitting configurations. Any practical combination may be specified for straight lengths of pipe or fittings other than bends.

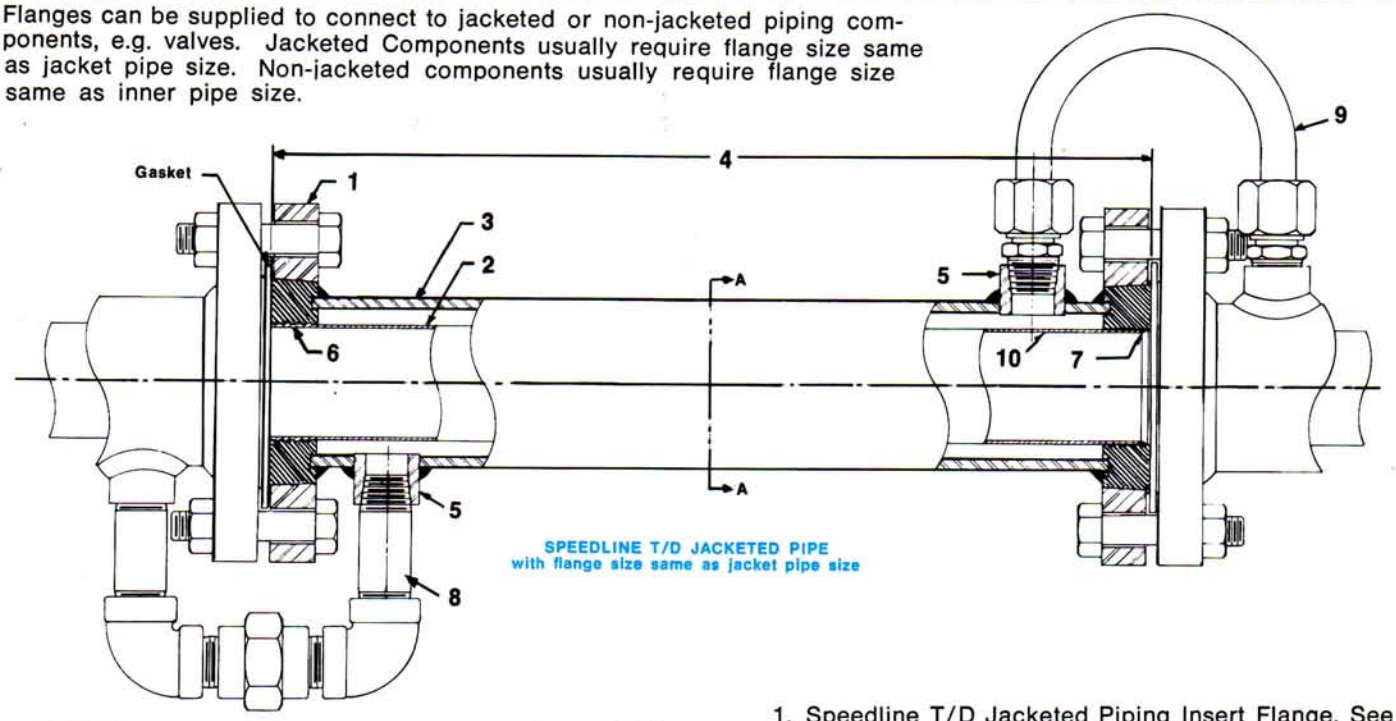
INNER PIPE SIZE	JACKET PIPE SIZE	INNER PIPE	JACKET PIPE	INNER PIPE WALL THICKNESS INSIDE DIAMETER				JACKET PIPE WALL THICKNESS INSIDE DIAMETER			
I.P.S. Sch 5-10-40-80	I.P.S. Sch 5-10-40-80	Outside Diameter	Outside Diameter	Sch 5	Sch 10	Sch 40	Sch 80	Sch 5	Sch 10	Sch 40	Sch 80
½	1	.840	1.315	.065 .710	.083 .674	.109 .622	.147 .546	.065 1.185	.109 1.097	.133 1.049	.179 .957
¾	1¼	1.050	1.660	.065 .920	.083 .884	.113 .824	.154 .742	.065 1.530	.109 1.442	.140 1.380	.191 1.278
1	1½	1.315	1.900	.065 1.185	.109 1.097	.133 1.049	.179 .957	.065 1.770	.109 1.682	.145 1.610	.200 1.500
1¼	2	1.660	2.375	.065 1.530	.109 1.442	.140 1.380	.191 1.278	.065 2.245	.109 2.157	.154 2.067	.218 1.939
1½	2½	1.900	2.875	.065 1.770	.109 1.682	.145 1.610	.200 1.500	.083 2.709	.120 2.635	.203 2.469	.276 2.323
2	3	2.375	3.500	.065 2.245	.109 2.157	.154 2.067	.218 1.939	.083 3.334	.120 3.260	.216 3.068	.300 2.900
2½	3½	2.875	4.000	.083 2.709	.120 2.635	.203 2.469	.276 2.323	.083 3.834	.120 3.760	.226 3.548	.318 3.364
3	4	3.500	4.500	.083 3.334	.120 3.260	.216 3.068	.300 2.900	.083 4.334	.120 4.260	.237 4.026	.337 3.826
4	6	4.500	6.625	.083 4.334	.120 4.260	.237 4.026	.337 3.826	.109 6.407	.134 6.357	.280 6.065	.432 5.761
6	8	6.625	8.625	.109 6.407	.134 6.357	.280 6.065	.432 5.761	.109 8.407	.148 8.329	.322 7.981	.500 7.625

INNER PIPE SIZE	JACKET PIPE SIZE	CROSS SECTIONAL ANNULUS AREA SQ. IN.				CROSS SECTIONAL ANNULUS AREA SQ. FT.			
I.P.S. Sch 5-10-40-80	I.P.S. Sch 5-10-40-80	Sch 5 Jacket	Sch 10 Jacket	Sch 40 Jacket	Sch 80 Jacket	Sch 5 Jacket	Sch 10 Jacket	Sch 40 Jacket	Sch 80 Jacket
½	1	.548	.391	.310	.165	.0038	.0027	.0022	.0011
¾	1¼	.964	.767	.629	.417	.0067	.0053	.0044	.0029
1	1½	1.102	.864	.678	.409	.0076	.0060	.0047	.0028
1¼	2	1.794	1.490	1.192	.789	.0125	.0103	.0083	.0055
1½	2½	2.926	2.615	1.950	1.403	.0203	.0181	.0135	.0097
2	3	4.296	3.913	2.959	2.175	.0298	.0272	.0205	.0151
2½	3½	5.05	4.61	3.39	2.40	.035	.032	.024	.017
3	4	5.13	4.63	3.10	1.88	.036	.032	.022	.013
4	6	16.32	15.82	12.98	10.16	.113	.110	.090	.071
6	8	21.04	20.01	15.56	11.19	.146	.139	.108	.078

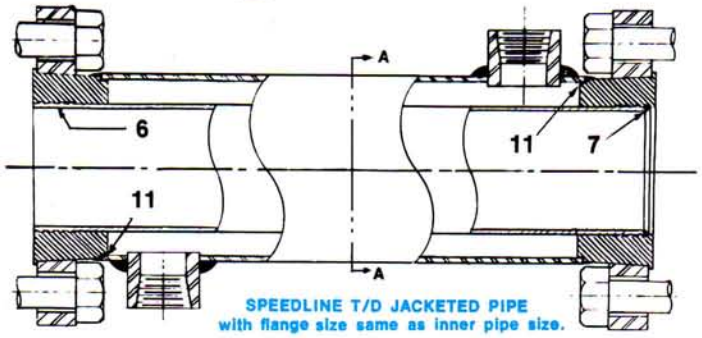
Speedline® T/D® JACKETED PIPING

TYPICAL DETAILS OF STRAIGHT JACKETED PIPE ILLUSTRATING SPEEDLINE VERSATILITY

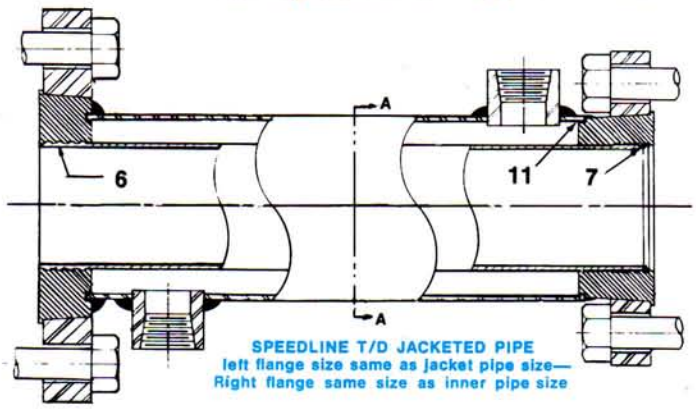
Flanges can be supplied to connect to jacketed or non-jacketed piping components, e.g. valves. Jacketed Components usually require flange size same as jacket pipe size. Non-jacketed components usually require flange size same as inner pipe size.



SPEEDLINE T/D JACKETED PIPE
with flange size same as jacket pipe size



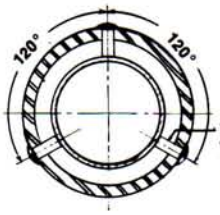
SPEEDLINE T/D JACKETED PIPE
with flange size same as inner pipe size.



SPEEDLINE T/D JACKETED PIPE
left flange size same as jacket pipe size—
Right flange same size as inner pipe size

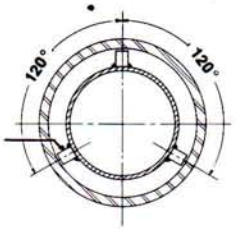
1. Speedline T/D Jacketed Piping Insert Flange. See pages 55 to 57 for dimensional data.
2. Inner pipe—Sch.5—10—40 or 80 as specified.
3. Jacket pipe—Sch.5—10—40 or 80 as specified.
4. Face to face length as specified.
   24′-0″ max. (with inner pipe in one piece)
   40′-0″ max. (longer lengths on application)
5. Jacket inlet or outlet—size, location, type connection, number and spacing optional.
6. Inner pipe expanded into insert—see detail at right for alternate fillet weld construction.
7. Inner pipe fillet welded to insert—see detail at left for alternate expanded method.
8. IPS pipe type "Jumpover."
   Note: Jumpovers are not normally supplied by Speedline but rather by the job site installers.
9. Tubing type "Jumpover" with hydraulic or compression type fittings.
10. When specified, inner pipe may be reinforced by "wear plates" at inlets, where erosion by impingement of heat transfer medium is expected.
11. Where inner pipe size flanges are shown, jacket pipe is fusion welded to insert. Drawing omits this weld to illustrate insert shoulder for concentric alignment of jacket pipe.
12. See page 53 for Ordering Considerations.

SECTION A-A
ALTERNATE SPACER DETAILS



1 group of 3 spacers —small diameter bar welded to jacket spaced 6″ C to C longitudinally.

10′-0″ max. insert face to center spacer.
10′-0″ max. between center spacer groups.



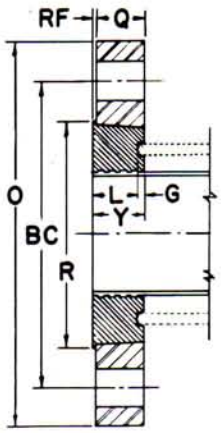
1 group of 3 spacers—rectangular bar tack-welded to inner pipe spaced 6″ C to C longitudinally.

150# T/D JACKETED PIPING INSERT FLANGE

U.S. Patent No. 3.284.112

Flange Size Same as Jacket Pipe Size

(Dimensions are in Inches)



Inner Pipe Size	Jacket Pipe Size	Flange Size	Flange Dimensions				Insert Dimensions[5]				
I.P.S. Sch. 5-10 40-80	I.P.S. Sch. 5-10 40-80[1]	150#	Outside Diam. O	Flange Thick. Q	Bolt Circle Diam. BC	No. & Diam. of Bolt Holes [2]	Gasket Face Diam. R[3]	Raised Face Thick. RF	Length of Insert Y	Gasket Face to Back of Recess L[4]	Depth of Groove G
½	1	1	4¼	9/16	3⅛	4—⅝	1 31/32	1/16	2 1/32	17/32	⅛
¾	1¼	1¼	4⅝	⅝	3½	4—⅝	2⅜	1/16	1 1/16	9/16	⅛
1	1½	1½	5	1 1/16	3⅞	4—⅝	2 21/32	1/16	¾	⅝	⅛
1¼	2	2	6	¾	4¾	4—¾	3 3/16	1/16	2 7/32	2 3/32	⅛
1½	2½	2½	7	⅞	5½	4—¾	3¾	1/16	1 5/16	1 3/16	⅛
2	3	3	7½	1 5/16	6	4—¾	4 13/32	1/16	1	⅞	⅛
2½	3½	3½	8½	1 5/16	7	8—¾	4 15/16	1/16	1⅛	1	⅛
3	4	4	9	1 5/16	7½	8—¾	5 15/32	1/16	1⅛	1	⅛
4	6	6	11	1	9½	8—⅞	7 23/32	3/32	1⅛	1 5/16	3/16
6	8	8	13½	1⅛	11¾	8—⅞	10	⅛	1⅜	1 3/16	3/16

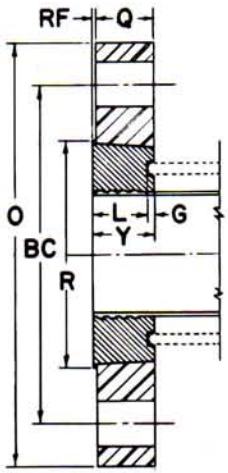
1. Standard jacket recess will accommodate Sch 5, 10 and 40 jacket pipe. If Sch 80 is to be used it must be specified.
2. Bolt holes are ⅛ larger than recommended bolt diameter.
3. To nearest 1/32.
4. Tolerance ±.010.
5. Gasket face of insert has machined concentric V grooves.

300# T/D JACKETED PIPING INSERT FLANGE

U.S. Patent No. 3,284,112

Flange Size Same as Jacket Pipe Size

(Dimensions are in Inches)



Inner Pipe Size	Jacket Pipe Size	Flange Size	Flange Dimensions				Insert Dimensions[5]				
I.P.S. Sch. 5-10 40-80	I.P.S. Sch. 5-10 40-80[1]	300#	Outside Diam. O	Flange Thick. Q	Bolt Circle Diam. BC	No. & Diam. of Bolt Holes [2]	Gasket Face Diam. R[3]	Raised Face Thick. RF	Length of Insert Y	Gasket Face to Back of Recess L[4]	Depth of Groove G
½	1	1	4⅞	1 1/16	3½	4—¾	1 31/32	1/16	¾	⅝	⅛
¾	1¼	1¼	5¼	¾	3⅞	4—¾	2⅜	1/16	1 3/16	1 1/16	⅛
1	1½	1½	6⅛	1 3/16	4½	4—⅞	2 21/32	1/16	⅞	¾	⅛
1¼	2	2	6½	⅞	5	8—¾	3 3/16	1/16	1 5/16	1 3/16	⅛
1½	2½	2½	7½	1	5⅞	8—⅞	3¾	1/16	1 1/16	1 5/16	⅛
2	3	3	8¼	1⅛	6⅝	8—⅞	4 13/32	1/16	1 3/16	1 1/16	⅛
2½	3½	3½	9	1 3/16	7¼	8—⅞	4 15/16	1/16	1¼	1⅛	⅛
3	4	4	10	1¼	7⅞	8—⅞	5 15/32	1/16	1 5/16	1 3/16	⅛
4	6	6	12½	1 7/16	10⅝	12—⅞	7 23/32	3/32	1 17/32	1 11/32	3/16
6	8	8	15	1⅝	13	12—1	10	⅛	1¾	1 9/16	3/16

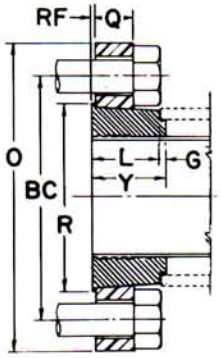
1. Standard jacket recess will accommodate Sch 5, 10 and 40 jacket pipe. If Sch 80 is to be used it must be specified.
2. Bolt holes are ⅛ larger than recommended bolt diameter.
3. To nearest 1/32.
4. Tolerance ±.010.
5. Gasket face of insert has machined concentric V grooves.

Speedline® 150# T/D JACKETED PIPING INSERT FLANGE

U.S. Patent No. 3,284,112

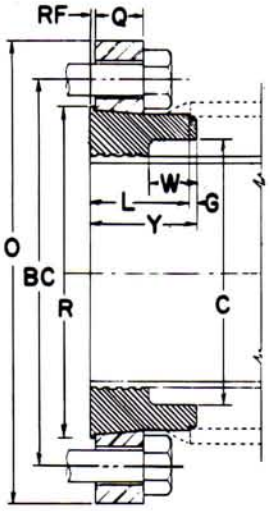
Flange Size Same as Inner Pipe Size

(Dimensions are in Inches)



Inner Pipe Size	Jacket Pipe Size	Flange Size	Flange Dimensions				Insert Dimensions[5]				
I.P.S. Sch. 5-10 40-80	I.P.S. Sch. 5-10 40-80[1]	150#	Outside Diam. O	Flange Thick-ness Q	Bolt Circle Diam. BC	No. & Diam. of Bolt Holes [2]	Gasket Face Diam. R[3]	Raised Face Thick. RF	Length of Insert Y	Gasket Face to Back of Shoulder L[4]	Depth of Shoulder G
½	1	½	3½	7/16	2⅜	4—⅝	1 13/32	1/16	1 1/16	1	1/16
¾	1¼	¾	3⅞	½	2¾	4—⅝	1¾	1/16	1⅛	1 1/16	1/16
1	1½	1	4¼	9/16	3⅛	4—⅝	2	1/16	1 3/16	1⅛	1/16
1¼	2	1¼	4⅝	⅝	3½	4—⅝	2 17/32	1/16	1¼	1 3/16	1/16
1½	2½	1½	5	11/16	3⅞	4—⅝	3	1/16	1⅜	1¼	⅛
2	3	2	6	¾	4¾	4—¾	3 11/16	1/16	1 7/16	1 5/16	⅛
2½	3½	2½	7	⅞	5½	4—¾	4 7/32	1/16	1 9/16	1 7/16	⅛
3	4	3	7½	15/16	6	4—¾	4 23/32	1/16	1⅝	1½	⅛

1. Jacket pipe schedule must be specified in order to provide proper shoulder diameter.
2. Bolt holes are ⅛ larger than recommended bolt diameter.
3. To nearest 1/32.
4. Tolerance ±.010.
5. Gasket face of insert has machined concentric V grooves.



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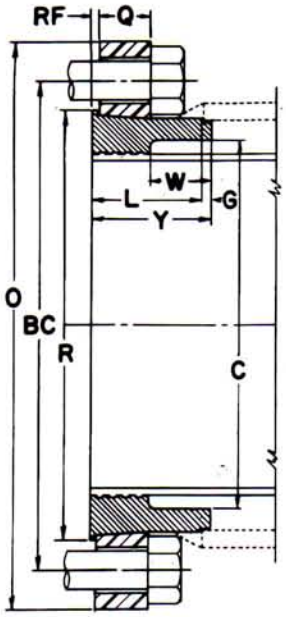

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Inner Pipe Size	Jacket Pipe Size	Flange Size	Flange Dimensions				Insert Dimensions [5]						
I.P.S. Sch. 5-10 40-80	I.P.S. Sch. 5-10 40-80[1]	150#	Outside Diam. O	Flange Thick-ness Q	Bolt Circle Diam. BC	No. & Diam. of Bolt Holes [2, 6]	Gasket Face Diam. R[3]	Raised Face Thick. RF	Length of Insert Y	Gasket Face to Back of Shoulder L[4]	Depth of Shoulder G	Counter Bore Diam. C	Counter Bore Depth W
4	6	4	9	15/16	7½	8—¾	6 13/32	1/16	2¼	2⅛	⅛	5 5/32	1⅛
6	8	6	11	1	9½	8—⅞	8⅜	3/32	2⅜	2 3/16	3/16	7 5/32	1¼

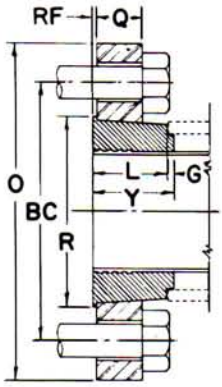
1. Jacket pipe schedule 40 or 80 must be specified in order to provide proper shoulder diameter. Jacket pipe schedules 5 or 10 require special adaptation.
2. Bolt holes are ⅛ larger than recommended bolt diameter.
3. To nearest 1/32.
4. Tolerance ±.010.
5. Gasket face of insert has machined concentric V grooves.
6. Recommend use of studs and 2 nuts due to close clearance.

Speedline® 300# T/D JACKETED PIPING INSERT FLANGE

U.S. Patent No. 3,284,112

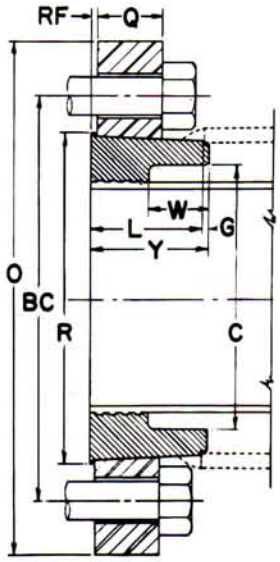
Flange Size Same as Inner Pipe Size

(Dimensions are in Inches)

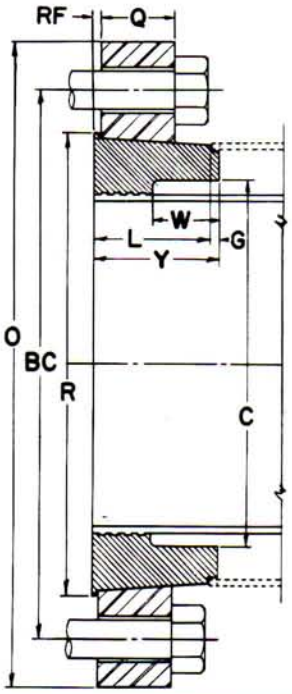


Inner Pipe Size	Jacket Pipe Size	Flange Size	Flange Dimensions				Insert Dimensions[5]				
I.P.S. Sch. 5-10 40-80	I.P.S. Sch. 5-10 40-80[1]	300#	Outside Diam. O	Flange Thick-ness Q	Bolt Circle Diam. BC	No. & Diam. of Bolt Holes [2]	Gasket Face Diam. R[3]	Raised Face Thick. RF	Length of Insert Y	Gasket Face to Back of Shoulder L[4]	Depth of Shoulder G
½	1	½	3¾	9/16	2⅝	4—⅝	1 13/32	1/16	1 3/16	1⅛	1/16
¾	1¼	¾	4⅝	⅝	3¼	4—¾	1 25/32	1/16	1¼	1 3/16	1/16
1	1½	1	4⅞	1 1/16	3½	4—¾	2	1/16	1 5/16	1¼	1/16
1¼	2	1¼	5¼	¾	3⅞	4—¾	2 17/32	1/16	1⅜	1 5/16	1/16
1½	2½	1½	6⅛	1 3/16	4½	4—⅞	3 1/32	1/16	1½	1⅜	⅛
2	3	2	6½	⅞	5	8—¾	3 23/32	1/16	1 9/16	1 7/16	⅛
2½	3½	2½	7½	1	5⅞	8—⅞	4 7/32	1/16	1 11/16	1 9/16	⅛
3	4	3	8¼	1⅛	6⅝	8—⅞	4 23/32	1/16	1 13/16	1 11/16	⅛

1. Jacket pipe schedule must be specified in order to provide proper shoulder diameter.
2. Bolt holes are ⅛ larger than recommended bolt diameter.
3. To nearest 1/32.
4. Tolerance ±.010.
5. Gasket face of insert has machined concentric V grooves.



(4x6x4)



(6x8x6)

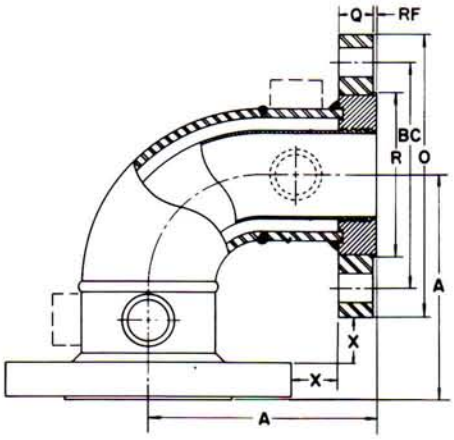
Inner Pipe Size	Jacket Pipe Size	Flange Size	Flange Dimensions				Insert Dimensions[5]						
I.P.S. Sch. 5-10 40-80	I.P.S. Sch. 5-10 40-80[1]	300#	Outside Diam. O	Flange Thick-ness Q	Bolt Circle Diam. BC	No. & Diam. of Bolt Holes [2, 6]	Gasket Face Diam. R[3]	Raised Face Thick. RF	Length of Insert Y	Gasket Face to Back of Shoulder L[4]	Depth of Shoulder G	Counter Bore Diam. C[3]	Counter Bore Depth W
4	6	4	10	1¼	7⅞	8—⅞	6 7/16	1/16	2 11/16	2 5/16	⅛	5 5/32	1 9/16
6	8	6	12½	1 7/16	10⅝	12—⅞	9	3/32	2 7/16	2¼	3/16	7 5/32	1 5/16

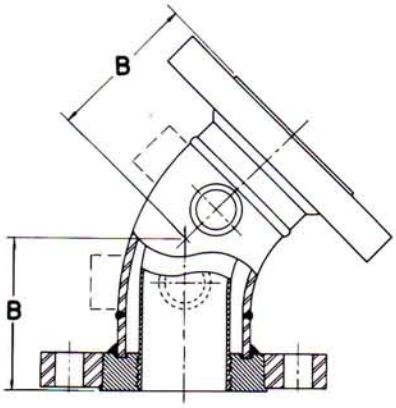
1. Jacket pipe schedule must be specified in order to provide proper shoulder diameter. 4" x 6" x 4" will accommodate Schedule 40 or 80 jacket. Jacket pipe Schedule 5 or 10 require special adaptation. 6" x 8" x 6" will accommodate Schedule 5, 10, 40 or 80 jacket but schedule must be specified.
2. Bolt holes are ⅛ larger than recommended bolt diameter.
3. To nearest 1/32.
4. Tolerance ±.010.
5. Gasket face of insert has machined concentric V grooves.
6. For 4" x 6" x 4" recommend use of studs and two nuts due to close clearance.

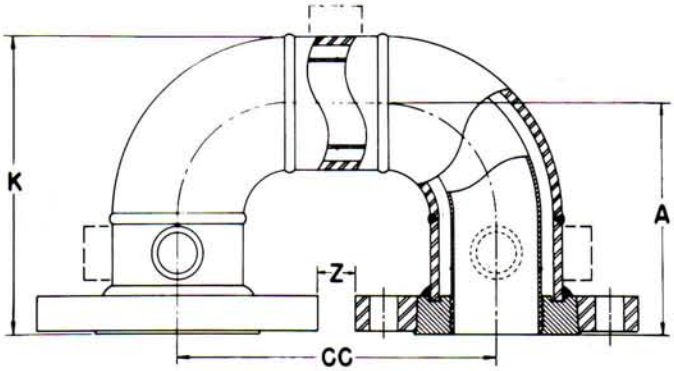
Speedline® JACKETED FITTINGS

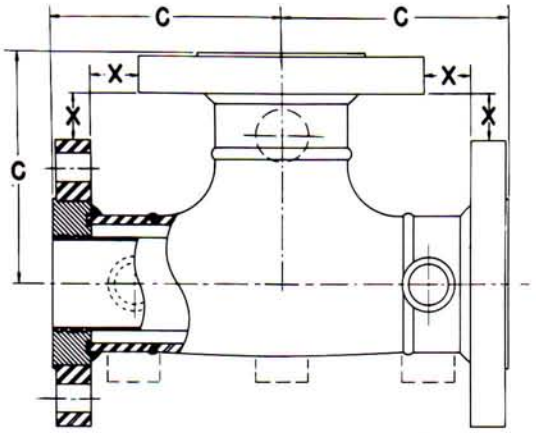
With 150# T/D Flanges Same Size as Jacket Pipe

(Dimensions are in Inches)









Inner Pipe Size	Jacket Pipe Size	Flange Size	Center to Face Dimension				Ctr. to Ctr.	Face to Back	Flange Data								
I.P.S. Sch 5-10 40-80	I.P.S. Sch 5-10 40-80	150#	90° Ell A	45° Ell B	Tee Cross C[1]	180° Return Bend A	180° Return Bend CC	180° Return Bend K[2]	O.D. O	Flange Thk. Q	Bolt Circle Dia. BC	No. & Dia. Bolt Holes	Gasket Face Dia. R[2]	Thk. Raised Face RF[4]	Suggested Inlet & Outlet Size[3]	90° Ell & Tee Flg. Clearance X	180° Flg. Clearance Z
½	1	1	4	2½	4	4	5⅜	4 21/32	4¼	9/16	3⅛	4—⅝	1 31/32	1/16	⅜	1 7/32	1⅛
¾	1¼	1¼	4¼	3	4¼	4¼	5¾	5 3/32	4⅝	⅝	3½	4—⅝	2⅜	1/16	½	1¼	1⅛
1	1½	1½	4½	3⅛	4½	4½	6⅝	5 7/16	5	11/16	3⅞	4—⅝	2 21/32	1/16	½	1¼	1⅝
1¼	2	2	5	3¼	5	5	7	6 3/16	6	¾	4¾	4—¾	3 3/16	1/16	¾	1 5/32	1
1½	2½	2½	5½	3½	5½	5½	8	6 15/16	7	⅞	5½	4—¾	3¾	1/16	¾	1 1/16	1
2	3	3	6	4	6	6	8½	7¾	7½	15/16	6	4—¾	4 13/32	1/16	¾	1¼	1
2½	3½	3½	6½	4½	6½	6½	10	8½	8½	15/16	7	8—¾	4 15/16	1/16	¾	1⅛	1½
3	4	4	7	5½	7	7	11	9¼	9	15/16	7½	8—¾	5 15/32	1/16	¾	1⅜	2
4	6	6	8½	6½	8½	8½	14¼	11 13/16	11	1	9½	8—⅞	7 23/32	3/32	¾	1⅞	3¼
6	8	8	11¼	8¼	11¼	11¼	18	15 9/16	13½	1 1/8	11¾	8—⅞	10	⅛	1	3⅛	4½

1. Center to face for reducing outlet tees and reducing outlet crosses are same as for straight tee and cross.
2. To nearest 1/32.
3. Two half-couplings per fitting is standard, on opposite sides, but size, number, type and location may vary to suit customer requirements. Dotted lines indicate alternate inlet and outlet locations.
4. Gasket face of insert has machined concentric V grooves.

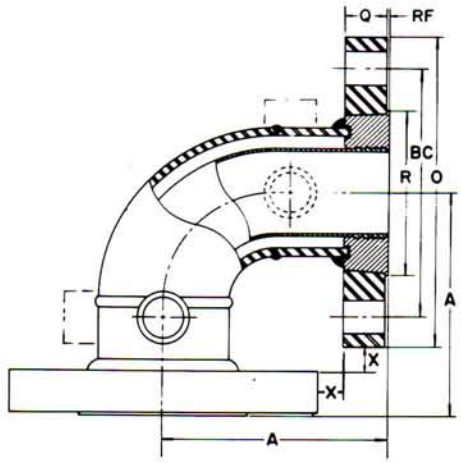
NOTE: Center to Face dimensions are identical in any size combination referenced above whether 150# or 300# flange rating—whether flange size is same as inner pipe—or flange size is same as jacket pipe size.

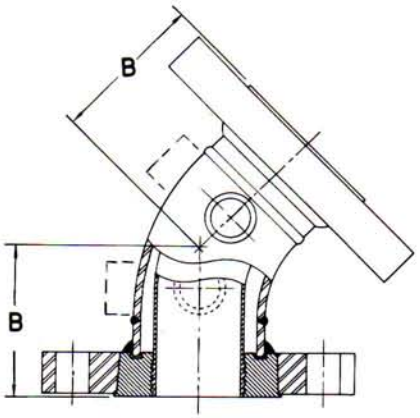
BEFORE ORDERING INDIVIDUAL JACKETED FITTINGS CONSIDER THE ADVANTAGES OF SPEEDLINE JACKETED ASSEMBLIES

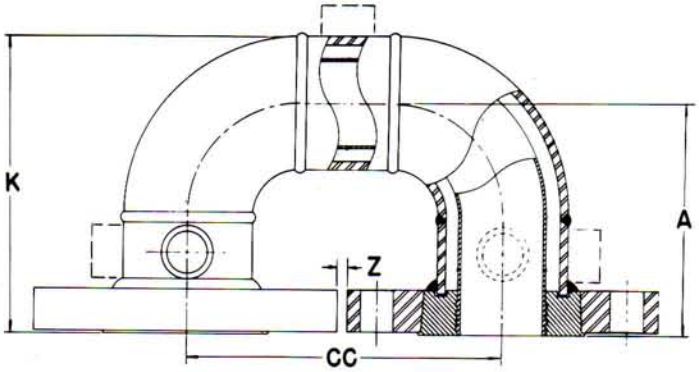
Speedline® JACKETED FITTINGS

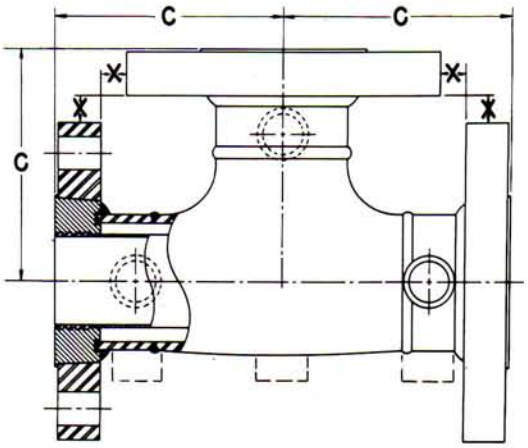
With 300# T/D Flanges Same Size as Jacket Pipe

(Dimensions are in Inches)









Inner Pipe Size	Jacket Pipe Size	Flange Size	Center to Face Dimension				Ctr. to Ctr.	Face to Back	Flange Data								
I.P.S. Sch 5-10 40-80	I.P.S. Sch 5-10 40-80	300#	90° Ell A	45° Ell B	Tee Cross C[1]	180° Return Bend A	180° Return Bend CC	180° Return Bend K[2]	O.D. O	Flange Thk. Q	Bolt Circle Dia. BC	No. & Dia. Bolt Holes	Gasket Face Dia. R[2]	Thk. Raised Face RF[4]	Sug-gested Inlet & Outlet Size[3]	90° Ell & Tee Fig. Clearance X	180° Fig. Clearance Z
½	1	1	4	2½	4	4	5⅜	4 21/32	4⅞	11/16	3½	4—¾	1 31/32	1/16	⅜	13/16	½
¾	1¼	1¼	4¼	3	4¼	4¼	5¾	5 3/32	5¼	¾	3⅞	4—¾	2⅜	1/16	½	13/16	½
1	1½	1½	4½	3⅛	4½	4½	6⅝	5 7/16	6⅛	13/16	4½	4—⅞	2 21/32	1/16	½	9/16	½
1¼	2	2	5	3¼	5	5	7	6 3/16	6½	⅞	5	8—¾	3 3/16	1/16	¾	13/16	½
1½	2½	2½	5½	3½	5½	5½	8	6 15/16	7½	1	5⅞	8—⅞	3¾	1/16	¾	11/16	½
2	3	3	6	4	6	6	8½	7¾	8¼	1⅛	6⅝	8—⅞	4 13/32	1/16	¾	11/16	¼
2½	3½	3½	6½	4½	6½	6½	10	8½	9	1 3/16	7¼	8—⅞	4 15/16	1/16	¾	¾	1
3	4	4	7	5½	7	7	11	9¼	10	1¼	7⅞	8—⅞	5 15/32	1/16	¾	11/16	1
4	6	6	8½	6½	8½	8½	14¼	11 13/16	12½	1 7/16	10⅝	12—⅞	7 23/32	3/32	¾	11/16	1¾
6	8	8	11¼	8¼	11¼	11¼	18	15 9/16	15	1⅝	13	12—1	10	⅛	1	2	3

1. Center to face for reducing outlet tees and reducing outlet crosses are same as for straight tee and cross.
2. To nearest 1/32.
3. Two half-couplings per fitting is standard, on opposite sides, but size, number, type and location may vary to suit customer requirements. Dotted lines indicate alternate inlet and outlet locations.
4. Gasket face of insert has machined concentric V grooves.

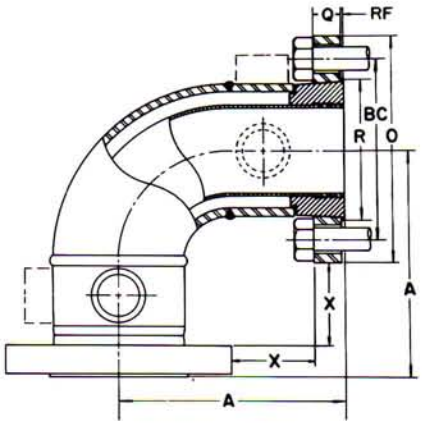
NOTE: Center to Face dimensions are identical in any size combination referenced above whether 150# or 300# flange rating—whether flange size is same as inner pipe—or flange size is same as jacket pipe size.

BEFORE ORDERING INDIVIDUAL JACKETED FITTINGS CONSIDER THE ADVANTAGES OF SPEEDLINE JACKETED ASSEMBLIES

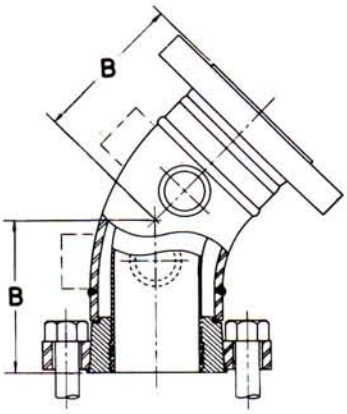
Speedline® JACKETED FITTINGS

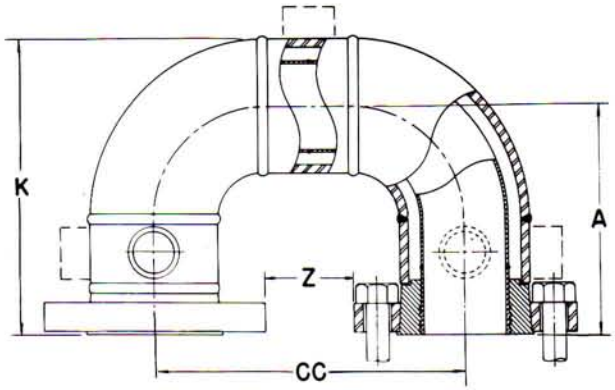
With 150# T/D Flange Same Size as Inner Pipe Size

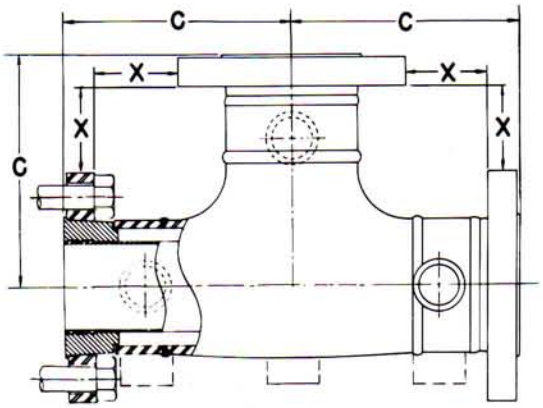
(Dimensions are in Inches)



Jacket pipe is fusion welded to insert. Drawing omits this weld to illustrate insert shoulder for concentric alignment of jacket pipe.







Inner Pipe Size	Jacket Pipe Size	Flange Size	Center to Face Dimension				Ctr. to Ctr.	Face to Back	Flange Data								
I.P.S. Sch 5-10 40-80	I.P.S. Sch 5-10 40-80	150#	90° Ell A	45° Ell B	Tee Cross C[1]	180° Return Bend A	180° Return Bend CC	180° Return Bend K[2]	O.D. O	Flange Thk. Q	Bolt Circle Dia. BC	No. & Dia. Bolt Holes	Gasket Face Dia. R[2]	Thk. Raised Face RF[4]	Suggested Inlet & Outlet Size[3]	90° Ell & Tee Flg. Clearance X	180° Flg. Clearance Z
½	1	½	4	2½	4	4	5⅜	4 21/32	3½	7/16	2⅜	4—⅝	1 13/32	1/16	⅜	1¾	1⅞
¾	1¼	¾	4¼	3	4¼	4¼	5¾	5 3/32	3⅞	½	2¾	4—⅝	1¾	1/16	½	1¾	1⅞
1	1½	1	4½	3⅛	4½	4½	6⅝	5 7/16	4¼	9/16	3⅛	4—⅝	2	1/16	½	1¾	2⅜
1¼	2	1¼	5	3¼	5	5	7	6 3/16	4⅝	⅝	3½	4—⅝	2 17/32	1/16	¾	2	2⅜
1½	2½	1½	5½	3½	5½	5½	8	6 15/16	5	11/16	3⅞	4—⅝	3	1/16	¾	2¼	3
2	3	2	6	4	6	6	8½	7¾	6	¾	4¾	4—¾	3 11/16	1/16	¾	2 3/16	2½
2½	3½	2½	6½	4½	6½	6½	10	8½	7	⅞	5½	4—¾	4 7/32	1/16	¾	2	3
3	4	3	7	5½	7	7	11	9¼	7½	15/16	6	4—¾	4 23/32	1/16	¾	2¼	3½
4[5]	6	4	8½	6½	8½	8½	14¼	11 13/16	9	15/16	7½	8—¾	6 13/32	1/16	¾	3	5¼
6[5]	8	6	11¼	8¼	11¼	11¼	18	15 9/16	11	1	9½	8—⅞	8⅜	3/32	1	4 21/32	7

1. Center to face for reducing outlet tees and reducing outlet crosses are same as for straight tee and cross.
2. To nearest 1/32.
3. Two half-couplings per fitting is standard, on opposite sides, but size, number, type and location may vary to suit customer requirements. Dotted lines indicate alternate inlet and outlet locations.
4. Gasket face of insert has machined concentric V grooves.
5. 4″ x 6″ x 4″ & 6″ x 8″ x 6″ (Recommended use of studs and two nuts due to clearances. Jacket Sch 40 or 80 only. Sch 5 or 10 Jacket requires special adaptation).

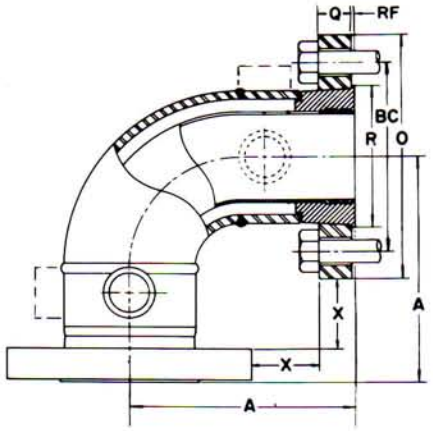
NOTE: Center to Face dimensions are identical in any size combination referenced above whether 150# or 300# flange rating—whether flange size is same as inner pipe—or flange size is same as jacket pipe size.

BEFORE ORDERING INDIVIDUAL JACKETED FITTINGS CONSIDER THE ADVANTAGES OF SPEEDLINE JACKETED ASSEMBLIES

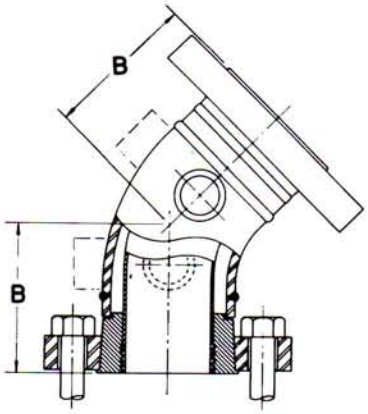
Speedline® JACKETED FITTINGS

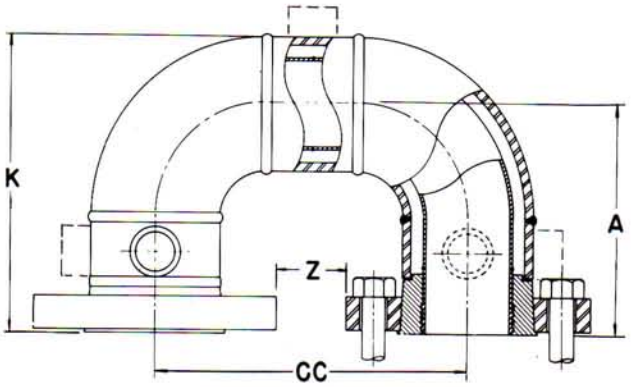
With 300# T/D Flanges Same Size as Inner Pipe Size

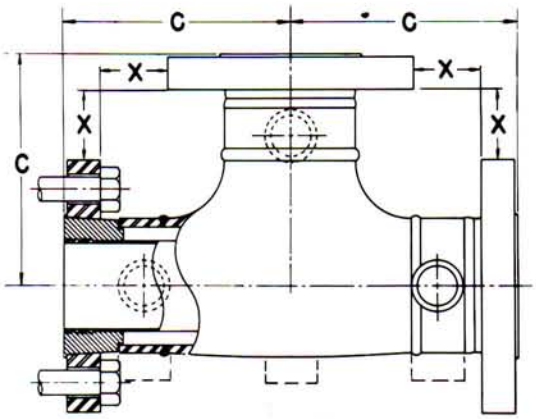
(Dimensions are in Inches)



Jacket pipe is fusion welded to insert. Drawing omits this weld to illustrate insert shoulder for concentric alignment of jacket pipe.







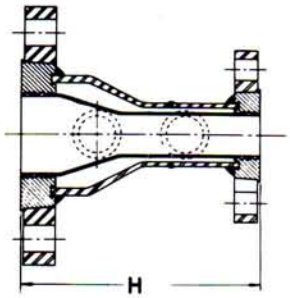
Inner Pipe Size	Jacket Pipe Size	Flange Size	Center to Face Dimension				Ctr. to Ctr.	Face to Back	Flange Data								
I.P.S. Sch 5-10 40-80	I.P.S. Sch 5-10 40-80	300#	90° Ell A	45° Ell B	Tee Cross C[1]	180° Return Bend A	180° Return Bend CC	180° Return Bend K[2]	O.D. O	Flange Thk. Q	Bolt Circle Dia. BC	No. & Dia. Bolt Holes	Gasket Face Dia. R[2]	Thk. Raised Face RF[4]	Suggested Inlet & Outlet Size[3]	90° Ell & Tee Flg. Clearance X	180° Flg. Clearance Z
½	1	½	4	2½	4	4	5⅜	4 21/32	3¾	9/16	2⅝	4—⅝	1 13/32	1/16	⅜	1⅞	1⅝
¾	1¼	¾	4¼	3	4¼	4¼	5¾	5 3/32	4⅝	⅝	3¼	4—¾	1 25/32	1/16	½	1¼	1⅛
1	1½	1	4½	3⅛	4½	4½	6⅝	5 7/16	4⅞	11/16	3½	4—¾	2	1/16	½	1 5/16	1¾
1¼	2	1¼	5	3¼	5	5	7	6 3/16	5¼	¾	3⅞	4—¾	2 17/32	1/16	¾	1 9/16	1¾
1½	2½	1½	5½	3½	5½	5½	8	6 15/16	6⅛	13/16	4½	4—⅞	3 1/32	1/16	¾	1 9/16	1⅞
2	3	2	6	4	6	6	8½	7¾	6½	⅞	5	8—¾	3 23/32	1/16	¾	1 13/16	2
2½	3½	2½	6½	4½	6½	6½	10	8½	7½	1	5⅞	8—⅞	4 7/32	1/16	¾	1 11/16	2½
3	4	3	7	5½	7	7	11	9¼	8¼	1⅛	6⅝	8—⅞	4 23/32	1/16	¾	1 11/16	2¾
4[5]	6	4	8½	6½	8½	8½	14¼	11 13/16	10	1¼	7⅞	8—⅞	6 7/16	1/16	¾	2 3/16	4¼
6[5]	8	6	11¼	8¼	11¼	11¼	18	15 9/16	12½	1 7/16	10⅝	12—⅞	9	3/32	1	3 15/32	5½

1. Center to face for reducing outlet tees and reducing outlet crosses are same as for straight tee and cross.
2. To nearest 1/32.
3. Two half-couplings per fitting is standard, on opposite sides, but size, number, type and location may vary to suit customer requirements. Dotted lines indicate alternate inlet and outlet locations.
4. Gasket face of insert has machined concentric V grooves.
5. 4" x 6" x 4" (Recommend use of studs and two nuts due to close clearances. Jacket Sch 40 or 80 only. Sch 5 or 10 Jacket requires special adaptation).

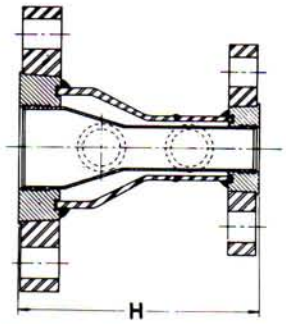
NOTE: Center to Face dimensions are identical in any size combination referenced above whether 150# or 300# flange rating—whether flange size is same as inner pipe—or flange size is same as jacket pipe size.

BEFORE ORDERING INDIVIDUAL JACKETED FITTINGS CONSIDER THE ADVANTAGES OF SPEEDLINE JACKETED ASSEMBLIES

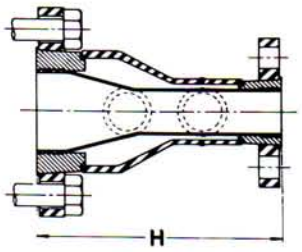
Speedline® JACKETED REDUCERS Concentric - Eccentric



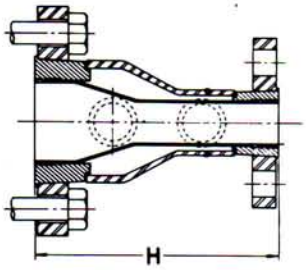
CONCENTRIC REDUCER
150# T/D Jacket Size Flanges



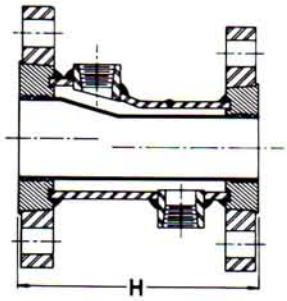
CONCENTRIC REDUCER
300# T/D Jacket Size Flanges



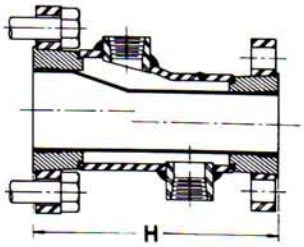
CONCENTRIC REDUCER
150# T/D Inner Size Flanges[7]



CONCENTRIC REDUCER
300# T/D Inner Size Flanges[7]



ECCENTRIC REDUCER
150# T/D Jacket Size Flanges



ECCENTRIC REDUCER
150# T/D Inner Size Flanges[7]

Inner Reducer Size Sch 5-10-40-80	Jacket Reducer Size Sch 5-10-40-80	Face to Face[2] H	Suggested[1] Inlet & Outlet Size	Flange Size [5,6] Same as Jacket Size 150# or 300#		Flange Size [5,6] Same as Inner Size 150# or 300#	
				Large End	Small End	Large End	Small End
¾ x ½	1¼ x 1	6	½	1¼	1	¾	½
1 x ½	1½ x 1	6	½	1½	1	1	½
1 x ¾	1½ x 1¼	6	½	1½	1¼	1	¾
1¼ x ¾	2 x 1¼	6	¾	2	1¼	1¼	¾
1¼ x 1	2 x 1½	6	¾	2	1½	1¼	1
1½ x ¾	2½ x 1¼	7	¾	2½	1¼	1½	¾
1½ x 1	2½ x 1½	7	¾	2½	1½	1½	1
1½ x 1¼	2½ x 2	7	¾	2½	2	1½	1¼
2 x 1	3 x 1½	7	¾	3	1½	2	1
2 x 1¼	3 x 2	7	¾	3	2	2	1¼
2 x 1½	3 x 2½	7	¾	3	2½	2	1½
2½ x 1¼	3½ x 2	8	¾	3½	2	2½	1¼
2½ x 1½	3½ x 2½	8	¾	3½	2½	2½	1½
2½ x 2	3½ x 3	8	¾	3½	3	2½	2
3 x 1¼	4 x 2	8	¾	4	2	3	1¼
3 x 1½	4 x 2½	8	¾	4	2½	3	1½
3 x 2	4 x 3	8	¾	4	3	3	2
3 x 2½	4 x 3½	8	¾	4	3½	3	2½
4 x 2	6 x 3	10	¾	6	3	4 [3,4]	2
4 x 2½	6 x 3½	10	¾	6	3½	4 [3,4]	2½
4 x 3	6 x 4	10	¾	6	4	4 [3,4]	3
6 x 3	8 x 4	12	1	8	4	6 [3]	3
6 x 4	8 x 6	12	1	8	6	6 [3,4]	4 [3,4]

1. Two Half Couplings per fitting is standard, on opposite sides, but size, number, type and location may vary to suit customer requirements.
2. Face to Face length may be increased on either large end or small end, or both, to incorporate pipe size reduction within a section of straight jacketed pipe or assembly.
3. 150# Flanges—recommend use of studs and two nuts due to close clearance. Use Sch 40 or Sch 80 Jacket only. Sch 5 or Sch 10 Jacket requires special adaptation.
4. 300# Flanges—recommend use of studs and two nuts due to close clearance. Use Sch 40 or Sch 80 Jacket only. Sch 5 or Sch 10 Jacket requires special adaptation.
5. Gasket face of insert has machined concentric V grooves.
6. Specify flange size and 150# or 300# rating. See appropriate preceding page for Flange Dimensional Data.
7. Jacket is fusion welded to insert. This weld is not illustrated in order to show detail or insert shoulder.

BEFORE ORDERING INDIVIDUAL JACKETED FITTINGS CONSIDER THE ADVANTAGES OF SPEEDLINE JACKETED ASSEMBLIES

Speedline® EXAMPLES OF T/D JACKETED SYSTEM VERSATILITY

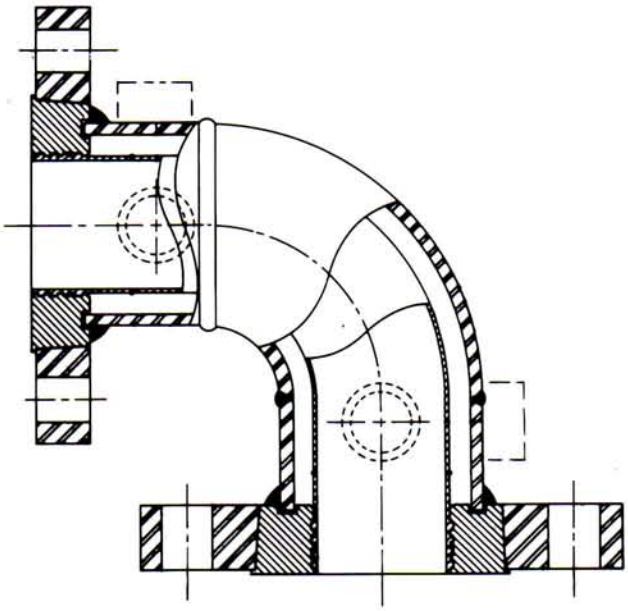


Illustration above shows a Jacketed 90 deg. Ell with a 150# Jacket Size Flange on one end and a 300# Jacket Size Flange on the other end.

Jacket pipe is fusion welded to insert. Drawing omits this weld to illustrate insert shoulder for concentric alignment of jacket pipe.

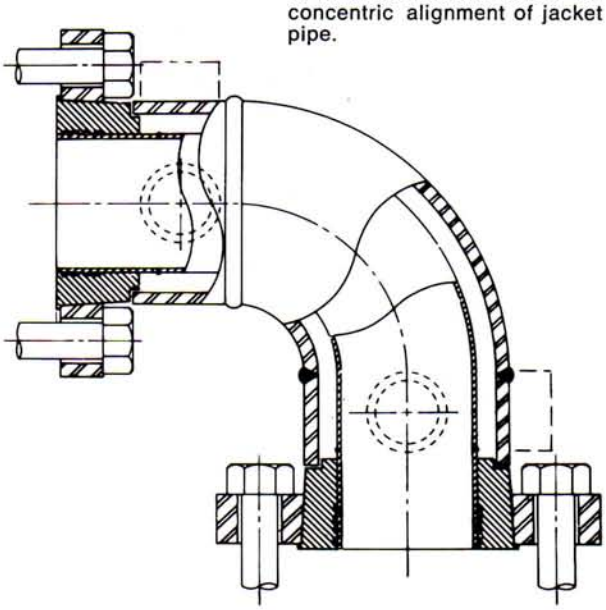
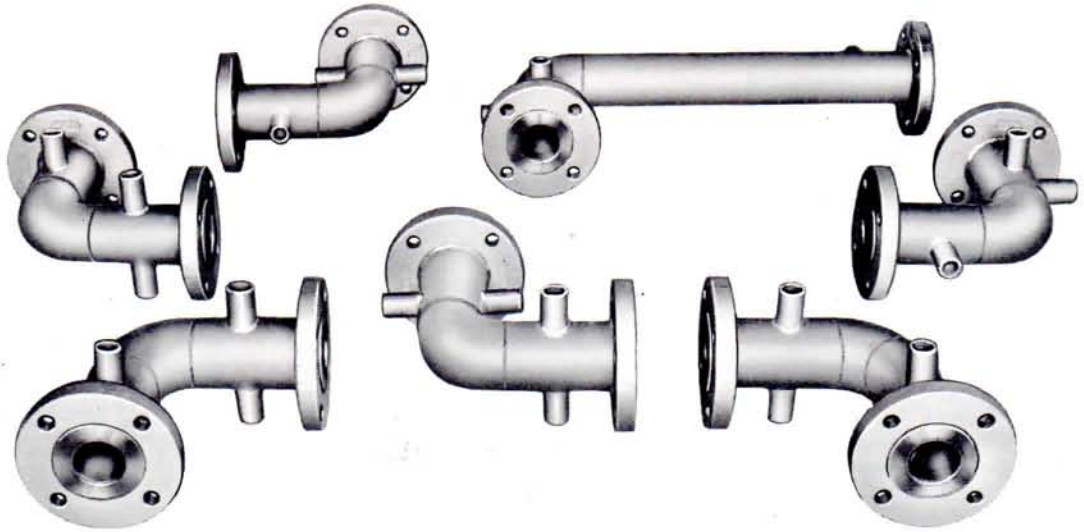
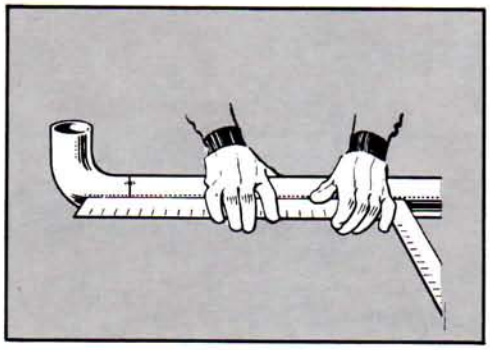


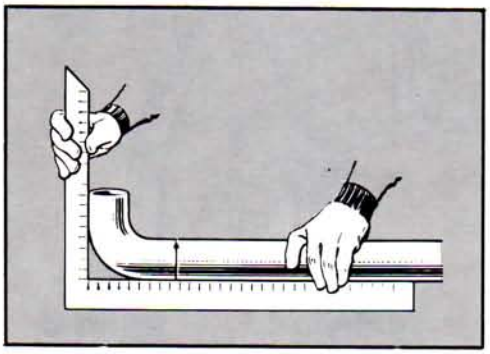
Illustration above shows a Jacketed 90 deg. Ell with a 150# Inner Size Flange on one end and a 300# Inner Size Flange on the other end.

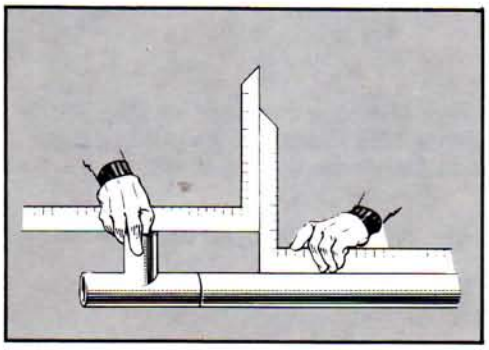
MANY ASSEMBLY COMBINATIONS ARE PRACTICAL AND SIMPLE WITH SPEEDLINE JACKETED SYSTEM DESIGN

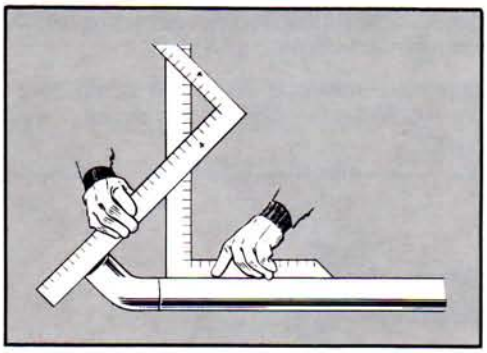
- Without changing center to face dimension
- With ample flange clearance
- Also applicable to tees, crosses, etc.
- Allows any combination of 150# or 300# Flange either jacket size or inner size
- Provides for use of inner size flanges which are frequently required when jacketed pipe, fittings, or assemblies are to be connected to non-jacketed valves, pumps, sight glasses and other non-jacketed components, which would have inner (product line) size flanges
- Jacket size flanges are required when the same components mentioned above are jacketed and usually have jacket size flanges











Speedline®

DESIGNED FOR EASIER ALIGNMENT AND ASSEMBLY

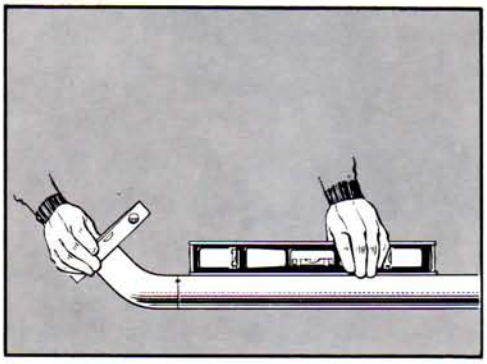
Speedline Tangential Fittings are the most versatile pipe fittings marketed today. Assembly can be readily accomplished by any one of the metallurgical joining methods such as welding, brazing or soldering. The Tangential feature makes the very same butt weld fitting equally advantageous for assembly by a mechanical method such as expanding (page 29).

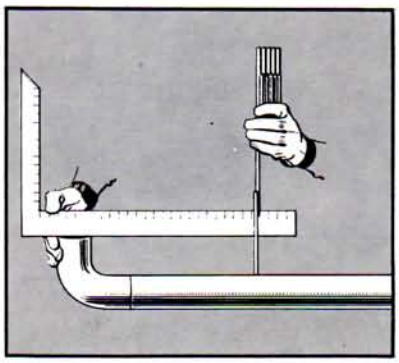
Extra fitting length also provides for use of Aligning Connectors (page 24) or Unions (page 26).

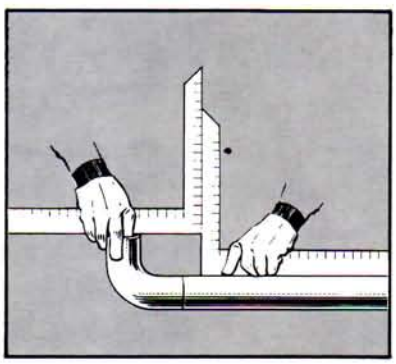
Speedline Belled End Fittings (page 39) have accurately formed socket ends that can be welded, brazed or soldered.

The versatility of Speedline provides distinct advantages which make the process piping job easier for the designer, fabricator or installer. Speedline fittings can be used for whichever assembly method or combination of methods is judged to be best suited to the particular application.

Extra length adds alignment advantages that can reduce assembly time and speed fit-up. Several alignment methods are shown on this page; each of which can have variations. Note how Speedline Tangential Design simplifies the procedures.







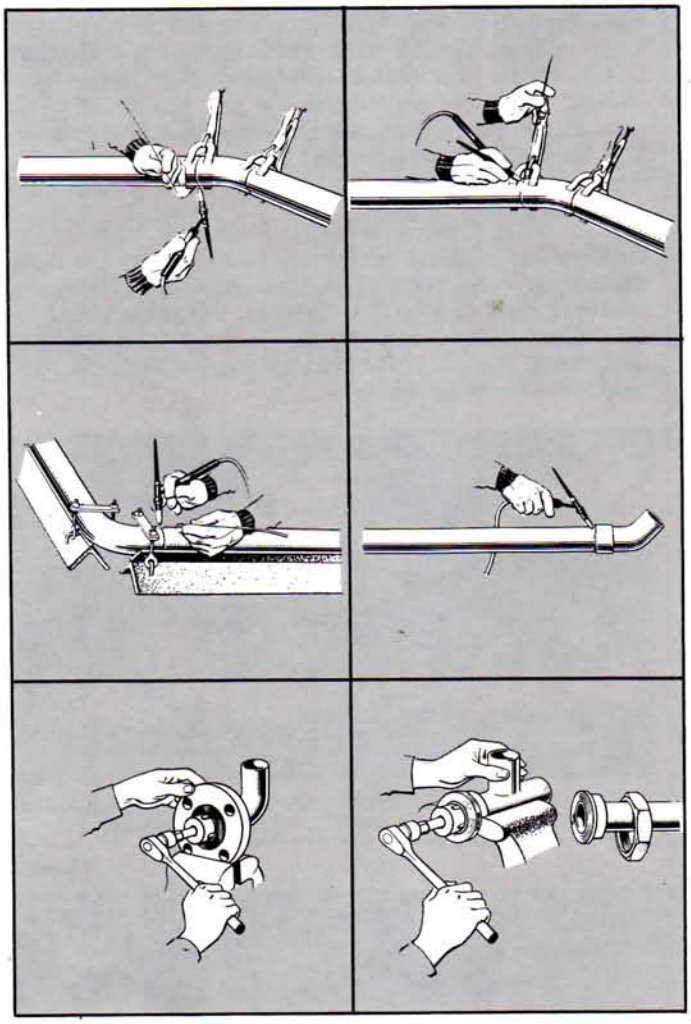
BUTT WELDS ARE ALWAYS STRAIGHT-TO-STRAIGHT WITH Speedline®

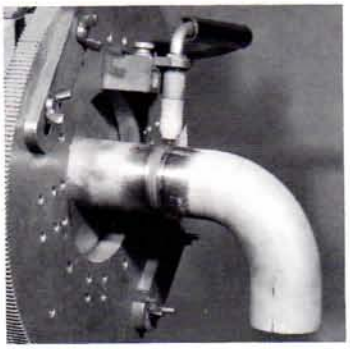
The advantages of welding **straight to straight** are many and are readily apparent when fit-up of process piping begins. There's more clearance to do the welding and, since the welds will be made at a point away from the change in direction the whole operation from fit-up through alignment, tacking and finish welding is facilitated.

Simple clamping arrangements, some of which are illustrated on this page, can be used to their fullest advantage with Speedline **Tangential** Fittings.

Commercially available clamps designed for holding sections of pipe for tacking or welding can also be used to clamp Speedline Tangential Fittings in position. The tangential feature makes the difference by providing plenty of room to properly position the clamp to insure true alignment.

When demountable joints are a requirement, the extra length on every end of every Speedline Fitting makes flanged or union connections (on one end or all ends) simply a matter of direct attachment by either expanding **or** welding.





DIMENSIONED FOR MACHINE WELDING

Extra fitting length is also very practical when automatic equipment is used. The increased clearances expedite setup and operation.

WELDING, BRAZING & SOLDERING INFORMATION IS LISTED ON FOLLOWING PAGES

More detailed information is available from the metal producers and welding equipment manufacturers. The American Welding Society is an excellent source for such information. The following four helpful references are listed:

- **Soldering Manual**
- **Brazing Manual**
- **Welding of Austenitic Chromium Nickel Steel Pipe & Tube**

BRAZING • SOLDERING STAINLESS STEELS

BRAZING

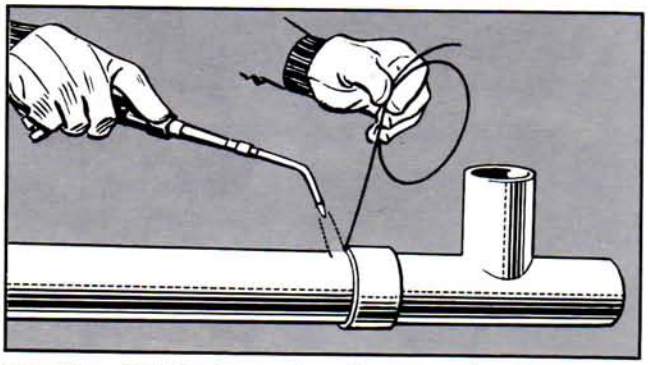
Stainless steels are readily and easily brazed when correct preparation and techniques are used.

Fit Tolerances. Typical fit tolerances of .004" to .016" should be maintained for good capillary action. Use Speedline Aligning Connectors (page 24) or Belled End Fittings (page 39) to expedite fit up and brazing procedure.

Clean & Flux. Proper cleaning and fluxing are important to all brazing and are especially so with the stainless steels. The O.D. of the pipe and the I.D. of the Aligning Connector or Belled End Fitting must be spotlessly clean. Then flux and assemble them within a few minutes. The brazed joints should be completed within no more than one-half hour after fluxing.

Brazing Alloy. Brazing alloy used should be carefully chosen to be compatible with the piping materials and the intended service. With very few exceptions these alloys will be of the AWS Filler Metal Classification B Ag. These filler metals are sometimes called *hard solders* or *silver solders.* When the proper alloy is chosen, use the flux recommended by the manufacturer. The American Welding Society's "Brazing Manual" contains lists of filler metal alloys and fluxes suitable for use on stainless steels.

Heating. Any heating device which will supply the right amount of even heat will be satisfactory for brazing stainless steel pipe and fittings. An oxygen and acetylene torch, using a neutral flame is the most commonly used heat source. After brazing excess flux and flux residues should be removed.



Speedline Aligning Connectors fit over ends of Speedline Fittings or pipe. Can be welded, brazed or soldered.

SOLDERING

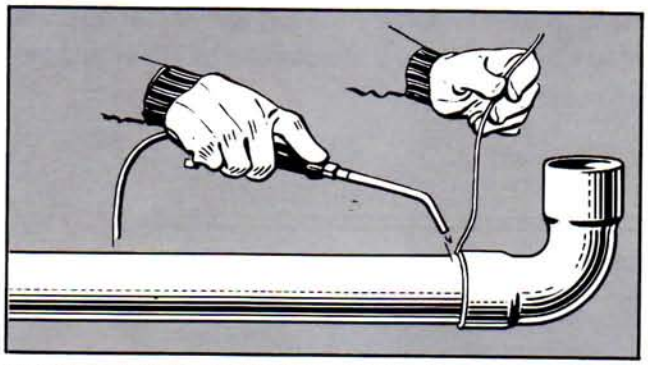
The stainless steels are readily and easily soldered when correct techniques and preparation are employed.

Fit Tolerances. Typical fit tolerances of .003 to .006 inches should be maintained for good capillary action. Fit-up without difficulty can be accomplished with dimensionally accurate Speedline Aligning Connectors or Belled End Fittings.

Clean & Flux. The O.D. of the pipe and the I.D. of the Aligning Connector or Belled End Fitting should be spotlessly clean. It is best to clean them with a fine emery paper, then flux and assemble the parts within a few minutes. An acid type flux should be used, and in most cases liquid acid fluxes work better on the stainless steels than do the paste fluxes.

Solder Alloy. Since most stainless steels are used to resist corrosion a solder alloy should be chosen that will also resist the corrosive materials or atmospheres to which the piping is exposed. If tin-lead solders are used an alloy containing not less than 50% tin is essential for high quality work. Many people use a 63% tin (eutectic) 37% lead alloy. For services where lead cannot be used a 95% tin, 5% silver alloy is often used. Use a flux recommended by the solder manufacturer to insure compatibility with the solder alloy.

Heating. Any heating device which will supply the right amount of even heat will be satisfactory for soldering stainless steel pipe. An acetylene and air torch is almost universally used. After soldering excess flux and flux residues should be removed. Washing with warm water will usually do the job.



Speedline Belled End Fittings simplify fit up for soldering, brazing or welding.

The same general techniques apply to Monel and Nickel pipe and fittings.

OUTLINE FOR PREPARATION OF A BRAZING OR SOLDERING PROCEDURE

1. **Base Metal.** Describe.
2. **End Preparation.** Specify how the pipe is to be cut and conditions of fit in the socket.
3. **Cleaning.** State how the pipe is to be cleaned. (Pickled, machined, filed, emeried, chemically cleaned, or a combination of several methods.)
4. **Fluxing.** List flux to be used and how it is to be applied.
5. **Brazing or Soldering Alloy.** Indicate the brazing or soldering alloy to be used.
6. **Method of Heating.** Tell if the parts are to be heated in a furnace or by a torch or by electrical apparatus or by some other means.
7. **Cooling.** Tell if the parts are to be cooled slowly, or in air, or by fast quenching.
8. **Cleaning.** Indicate how flux is to be removed and the parts cleaned for acceptance.
9. **Testing and Inspection.** Define how the completed assembly is to be tested and inspected.

WELDING STAINLESS STEEL PROCESS PIPING AND Speedline® FITTINGS

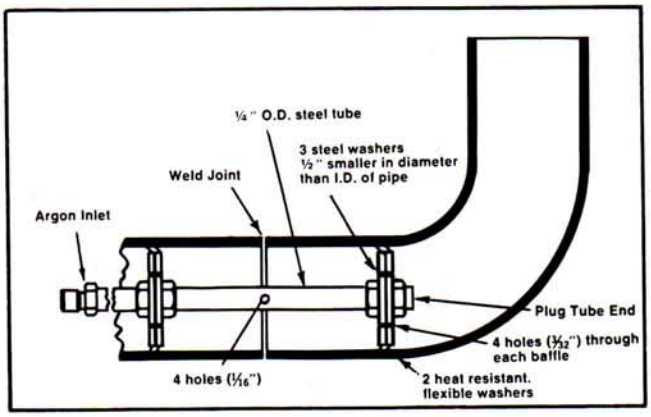
Electric Arc Welding. Almost all stainless steel pipe is welded today by the electric arc method. For relatively heavy walls of one quarter inch and up, or for heavy sections such as flanges, coated electrodes with lime or titania type coating and a D.C. power source are used. For most lighter wall pipe inert gas shielded arc welding with a D.C. power source is used for both butt and fillet welds.

Current & Electrodes. D.C. reverse polarity (electrode positive) should be used for covered electrodes. D.C. straight polarity (electrode negative) should be used for inert gas shielded welding.

For inert gas shielded, tungsten electrode welding of stainless steels, 2% thoriated tungsten should be used. The tungsten electrode should be sharpened to a pencil point and kept that way, by regrinding when necessary. No more heat than is necessary to melt the metal should be used. This means that the amperage should be kept as low as is possible and still melt the inside edge of the pipe wall.

Shielding Gas. Argon should be the shielding gas for all but a few special cases. It should be controlled by an Argon flow meter and regulator and should reach the weld area through a **nozzle** or **cup** at the end of the **torch** or electrode holder. This cup should be wide enough to cover the weld area. The Argon should flow at from eight to fifteen cubic feet per hour, for most joints, but at a rate that causes as little turbulence as possible, commensurate with the amount of gas required. If more gas is required change to a larger cup as the gas flow is increased.

If superior quality welds are required a **back-up** or **purge** of inert gas should be used inside the pipe. See drawing below:



Inert Gas Back-Up

Cleaning & Degreasing. Pipe and fittings should be cleaned and degreased and the surfaces to be welded should be brushed with a stainless wire brush before assembly. If there are burrs or rough edges on the pipe they should be smoothed with a file or grinding wheel.

Alignment & Tacking. After proper alignment the joint should be "tacked" in four places. After welding is started one pass around the pipe should be completed without interruption so as to avoid warping or drawing. Filler metal is not normally required in the lighter sections but may be used if desired.

Filler Metal. Filler metal, if required, should be chosen to be compatible with the piping material. Generally, smaller sizes of filler metal rods are advantageous. On welds in pipe four inch and smaller filler metal should not be over 3/32" or ⅛" in diameter.

Inspection. If there are any cracks, pinholes or undercut, they should be filed or ground out to clean metal before applying another pass. If such defects appear in the finished weld, they should be ground out and necessary repairs made.

Oxy-acetylene Welding. Light wall pipe and Speedline fittings can be successfully welded with oxy-acetylene flame. For good results the weld area must be carefully cleaned and fluxed and the welder must be experienced in this particular application. Unless there is some special reason for oxy-acetylene welding, it is not recommended for stainless piping.

Welding Procedures. To assure consistently sound joints a welding procedure should be prepared. It may require very little or a great deal of detail, depending on the type of work to be done. Basic requirements are listed in outline below:

OUTLINE FOR PREPARATION OF A WELDING PROCEDURE

1. **Base Metal.** Describe.
2. **End Preparation.** Specify how the pipe is to be cut; the bevel and cleaning (if any). Whatever needs to be done to prepare ends for welding.
3. **Alignment.** List alignment requirements, how they are to be met and how the pipe is to be spaced.
4. **Welding Process.** Decide process to be used, such as oxy-acetylene, electric arc, coated consumable electrodes, inert gas shielded, etc. Then give details of tip size, flame, etc.; or voltage, amperage and electrode size. If arc welding, give current characteristics (A.C. or D.C.) and electrode positive or negative.
5. **Shielding.** Tell how the weld is to be shielded. With flux painted on, or with flux from electrode, or with shielding gas. If the inside of the pipe is to be purged and/or shielded give details.
6. **Preheat & Interpass Temperatures.** Preheat and interpass temperature control, if required.
7. **Filler Metal.** Indicate filler metal to be used. If none is required, say so.
8. **Number of Passes.** Stipulate how many layers of weld metal to be deposited.
9. **Cleaning.** State how the weld is to be cleaned between passes (may be only wire brushing) and what cleaning is required after completion. (Removal of flux, or brushing, or pickling.)
10. **Appearance of Finished Weld.** Tell if the weld is to be flat or built-up or any other information required.
11. **Post Heat and/or Quench.** If required.
12. **Testing and Inspection.** Define how the completed assembly will be tested and inspected.

JOINING ALUMINUM PROCESS PIPING

WELDING

Inert gas shielded arc welding, with tungsten electrodes is recommended for Aluminum pipe and fittings. Aluminum piping can also be welded with an oxy-acetylene flame or with coated electrodes, but it is a much more difficult procedure requiring considerable experience to insure good welds. In addition to butt welding Speedline Fittings can be socket joined with Speedline Aligning Connectors or Speedline Belled End Fittings.

AC Current & Tungsten Electrodes. The most widely used method of welding Aluminum uses AC current with super-imposed high frequency. A tungsten electrode is used with Argon shielding gas. With this method the AC current helps to break up and separate the oxide, which is always present on Aluminum, so that the weld metal will "wet". The high frequency helps to initiate and stabilize the arc.

Shielding Gas. Argon gas should be the shielding medium and it should be controlled by an Argon flowmeter and regulator. It should leave the torch through a ceramic, rather than metal, cup so as not to short out the arc through the cup. A cup large enough to deliver the shielding gas with reasonably little turbulence should be used.

DC Current & Tungsten Electrodes. In some cases, because of availability of equipment, DC current with non-consumable tungsten electrodes is used for welding Aluminum. When this process is used Helium should be the shielding gas. The electrode should be negative and the work positive (straight polarity). Since the welding current does not break up the oxide, as does AC current, the weld zone requires more pre-cleaning and inter-pass cleaning.

DC Current & Consumable Electrodes. Some fabricators use consumable electrode gas shielded welding on aluminum piping. This method uses DC current and reverse polarity (electrode positive) and Argon shielding. Sometimes a mixture of Argon and Helium is used. The filler metal is also the electrode and is fed through the welding torch or holder from a coil of wire. Though this process is very simple and easy to operate a specific procedure should be prepared before using this method of welding.

Cleaning & Degreasing. All pipe and fitting ends and all weld areas should be cleaned with a solvent to remove grease and dirt. This is usually sufficient cleaning. If brushing is required to remove heavy dirt be sure to use a stainless wire brush.

Alignment & Tacking. After proper alignment the joint should be tacked in four places. When welding is started, one pass around the pipe should be completed without interruption so as to avoid warping or distortion.

Filler Metal. Welds in Aluminum should not be made without the addition of filler metal. A filler metal alloy should be chosen to be compatible with the base metal. For non-consumable electrode welding a one eighth inch diameter clean filler wire is usually used.

Cleaning & Inspection. Welds should be cleaned between passes with a stainless wire brush. If there are any cracks, pinholes or undercuts they should be ground out to clean metal before depositing another pass. If such defects appear in the finished weld, they should be ground out and necessary repairs made.

BRAZING

The Aluminum alloys listed in this catalog may be readily brazed, but it should be done with special care since melting points of the base metals and the brazing alloys are relatively close.

Fit Tolerances. Typical fit tolerance of .010" to .025" should be maintained for good capillary action. Use Speedline Aligning Connectors (page 24) or Belled End Fittings (page 39) to expedite fit up and brazing procedure.

Clean & Flux. Aluminum pipe fittings and filler metal must be cleaned before fluxing and assembling. Usually a commercial solvent cleaner or degreaser can be used to remove dirt and grease. With parts that have been worked and shaped the cleaning should be done with an etchant cleaner, such as a 5% sodium hydroxide dip followed by a rinse in cold water.

Filler Metal. Filler metals should be carefully chosen to suit the base metal and the piping service, remembering that the flow point of most aluminum brazing alloys is less than 200°F below that of the base metal. The filler metals used will usually fall in the A.W.S. B Al Si Classification. Fluxes should be those recommended by the manufacturer of the brazing alloy.

Heating. Any source that supplies the right amount of even heat will be satisfactory. An oxygen and acetylene torch is the most commonly used source of heat, and in this case a slightly reducing (excess acetylene) flame should be used. After brazing excess flux and flux residues should be removed.

SOLDERING

Aluminum calls for more care in choice of flux and alloy and more careful manipulation than most other piping materials.

Fit Tolerances. Typical fit tolerances of .005" to .015" should be maintained for good capillary action. Fit-up without difficulty can be accomplished with dimensionally accurate SPEEDLINE Aligning Connectors or Belled End Fittings.

Clean & Flux. All grease or dirt should be removed before flux is applied. If the O.D. of the pipe and the I.D. of the Aligning Connectors or Belled End Fittings are clean the flux can be applied without special preparation. Use a flux recommended by the manufacturer of the solder alloy.

Solder. Choose a solder that is compatible with the piping material and with the service for which the piping is intended. Most of these will be alloys of Tin and Zinc or alloys of Cadmium and Zinc. Their melting points will be as low as 390°F and as high as 750°F.

Heating. Any heating device which will supply enough even heat will be satisfactory for soldering Aluminum. Acetylene and air torches are most commonly used. Remember that some Aluminum alloys melt as low as 1025°F and the others only up to 1225°F. Care must be taken not to melt the pipe and fittings. After soldering excess flux and flux residues should be removed.

ALLOWABLE INTERNAL WORKING PRESSURES FOR CORROSION RESISTANT PIPE AT VARIOUS TEMPERATURES

(Code also covers higher temperatures than included in these tables)

Code information cited in this section has been extracted from Petroleum Refinery Piping Code—USAS (ASA) B31.3–1966, a section of the American Standard Code for Pressure Piping published by the American Society of Mechanical Engineers, New York, N. Y.

The designer is cautioned that the Code is not a design handbook. The Code does not do away with the need for the engineer or for competent engineering judgment.

Excerpt from USAS (ASA) B31 Case No. 49—Chemical Process piping may be designed, fabricated, inspected and tested in accordance with USAS (ASA) B31.3–1966.

301.2.2 *Internal Design Pressure*

The piping component shall be designed for an internal pressure representing the most severe condition of coincident pressure and temperature expected in normal operation (including fluid head). The most severe condition of coincident pressure and temperature under normal operation shall be that condition which results in the greatest required pipe thickness and the highest flange rating.

304.1.1 *General*

(a) The required thickness of straight sections of pipe, considering pressure and mechanical, corrosion and erosion allowances, shall be determined in accordance with Equation 2.

$$t_m = t + c \quad \ldots\ldots\ldots\ldots\ldots\ldots (2)$$

t_m = minimum required thickness, satisfying requirements for pressure, and mechanical, corrosion and erosion allowances, inches.

t = pressure design thickness as calculated in accordance with 304.1.2 for internal pressure.

c = for internal pressure, the sum of the mechanical allowances (thread depth and groove depth), corrosion and erosion allowances, inches. (See 302.4).

P = internal design pressure, (see 301.2.2), psig.

D_o = outside diameter of pipe, inches.

S = applicable allowable stresses in accordance with 302.3.1 and Tables 302.13.1A and 302.3.1B (see Appendix A) psi.

E = longitudinal weld joint factor (see Table 302.4.3).

Y = coefficient having values as given in Table 304.1.1 for ductile ferrous materials, a value of 0.4 for ductile nonferrous materials, and a value of zero for brittle materials such as cast iron.

304.1.2 *Straight Pipe Under Internal Pressure*

(a) For metallic pipe, the internal pressure design thickness (t) shall be not less than calculated by the following equation 3, if t is less than $D_o/4$:

$$t = \frac{PD_o}{2(SE + PY)} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (3)$$

In addition to above references, all other aspects of the Code should be considered before making any design decisions.

FOLLOWING TABLES WERE CALCULATED USING:

Equation (3) algebraically rearranged

$$P = \frac{2t}{D_o - 0.8t} \times SE$$

c = 0 (design engineers should make proper allowances)

t = 87½% of nominal pipe wall thickness

y = 0.4

Stainless Steels and Alloy 20Cb-3 Pipe

ALLOWABLE INTERNAL WORKING PRESSURE (psig)

SCH 5, 10, 40 Welded Stainless Steel Pipe ASTM - A312 (Alloy 20Cb-3 ASTM-B464) SCH 80 Seamless Stainless Steel Pipe ASTM - A312 (Alloy 20Cb-3 ASTM-B464)																
	TYPE	−425[1] TO 100	METAL TEMPERATURE - DEGREES F													
			200	300	400	500	600	650	700	750	800	850	900	950	1000	1050
½" SCH 5	304	2154	1910	1723	1565	1436	1335	1292	1242	1192	1149	1113	1070	1048	1012	976
	304L	1795	1752	1508	1264	1113	1034	1005	976	955	926					
	316	2154	2154	2053	2010	1975	1967	1960	1953	1939	1910	1896	1838	1738	1608	1400
	316L	1795	1795	1666	1379	1264	1163	1127	1084	1041	1012					
	20Cb-3	2585	2412	2332	2286	2229	2148	2114	2079	2045	2010					
½" SCH 10	304	2801	2483	2240	2035	1867	1736	1680	1615	1550	1494	1447	1391	1363	1316	1269
	304L	2334	2278	1960	1643	1447	1344	1307	1269	1242	1204					
	316	2801	2801	2670	2614	2567	2558	2548	2539	2520	2483	2464	2390	2259	2091	1820
	316L	2334	2334	2166	1792	1643	1512	1466	1410	1354	1316					
	20Cb-3	3361	3137	3032	2972	2898	2793	2748	2703	2659	2614				•	
½" SCH 40	304	3730	3308	2984	2711	2487	2313	2238	2151	2064	1990	1927	1853	1815	1753	1691
	304L	3109	3034	2611	2188	1927	1791	1741	1691	1654	1604					
	316	3730	3730	3556	3482	3420	3407	3395	3382	3357	3308	3283	3183	3009	2785	2425
	316L	3109	3109	2885	2387	2189	2014	1952	1878	1803	1753					
	20Cb-3	4477	4178	4039	3959	3860	3721	3661	3601	3541	3482					

[1]Code case 1188-4 stipulates minimum temperature of −20°F for Alloy 20Cb-3

Listings continued on next page.

ALLOWABLE INTERNAL WORKING PRESSURE (psig)

SCH 5, 10 40 Welded Stainless Steel Pipe ASTM - A312 (Alloy 20Cb-3 ASTM-B464)
SCH 80 Seamless Stainless Steel Pipe ASTM - A312 (Alloy 20Cb-3 ASTM-B464)

	TYPE	METAL TEMPERATURE - DEGREES F														
		−425(1) to 100	200	300	400	500	600	650	700	750	800	850	900	950	1000	1050
½" SCH 80	304	6564	5829	5252	4779	4376	4061	3921	3781	3641	3501	3396	3291	3186	3081	2976
	304L	5462	5357	4586	3851	3396	3151	3063	2976	2906	2836					
	316	6564	6564	6267	6127	6022	5987	5969	5952	5917	5864	5777	5602	5287	4901	4271
	316L	5462	5462	5076	4201	3851	3554	3431	3308	3186	3081					
	20Cb-3	7877	7352	7107	6967	6792	6547	6442	6337	6232	6127					
¾"SCH 5	304	1703	1510	1362	1237	1135	1056	1022	982	942	908	880	846	829	800	772
	304L	1419	1385	1192	999	880	817	795	772	755	732					
	316	1703	1703	1623	1589	1561	1555	1549	1544	1532	1510	1498	1453	1373	1271	1107
	316L	1419	1419	1317	1090	999	919	891	857	823	800					
	20Cb-3	2043	1907	1843	1807	1762	1698	1671	1643	1616	1589					
¾" SCH 10	304	2208	1958	1766	1604	1472	1369	1325	1273	1222	1178	1141	1097	1075	1038	1001
	304L	1840	1796	1546	1295	1141	1060	1030	1001	979	949					
	316	2208	2208	2105	2061	2024	2017	2009	2002	1987	1958	1943	1884	1781	1649	1435
	316L	1840	1840	1708	1413	1295	1192	1156	1111	1067	1038					
	20Cb-3	2650	2473	2391	2343	2285	2202	2167	2131	2096	2061					
¾" SCH 40	304	3059	2712	2447	2223	2039	1896	1835	1764	1692	1631	1580	1519	1488	1437	1387
	304L	2549	2488	2141	1794	1580	1468	1427	1387	1356	1315					
	316	3059	3059	2916	2855	2804	2793	2783	2773	2753	2712	2691	2610	2467	2284	1988
	316L	2549	2549	2365	1957	1794	1652	1601	1539	1478	1437					
	20Cb-3	3670	3426	3311	3246	3165	3050	3001	2952	2904	2855					
¾" SCH 80	304	5374	4772	4299	3912	3583	3325	3210	3095	2981	2866	2780	2694	2608	2522	2436
	304L	4471	4385	3754	3153	2780	2579	2508	2436	2379	2321					
	316	5374	5374	5130	5016	4930	4901	4887	4872	4844	4801	4729	4586	4328	4012	3497
	316L	4471	4471	4156	3439	3153	2909	2809	2708	2608	2522					
	20Cb-3	6449	6019	5818	5703	5560	5359	5273	5187	5101	5016					
1" SCH 5	304	1347	1195	1078	979	898	835	808	777	746	719	696	669	656	633	611
	304L	1123	1096	943	791	696	647	629	611	597	579					
	316	1347	1347	1285	1258	1235	1231	1226	1222	1213	1195	1186	1150	1087	1006	876
	316L	1123	1123	1042	862	791	728	705	678	651	633					
	20Cb-3	1617	1509	1459	1430	1394	1344	1322	1301	1279	1258					
1" SCH 10	304	2296	2039	1840	1671	1533	1426	1380	1326	1272	1226	1188	1142	1119	1081	1042
	304L	1916	1870	1610	1349	1188	1104	1073	1042	1019	989					
	316	2300	2300	2192	2146	2108	2100	2093	2085	2070	2039	2024	1962	1855	1717	1495
	316L	1916	1916	1778	1472	1349	1242	1203	1157	1111	1081					
	20Cb-3	2759	2575	2490	2441	2379	2293	2257	2220	2183	2146					
1" SCH 40	304	2847	2524	2278	2069	1898	1765	1708	1642	1575	1518	1471	1414	1386	1338	1291
	304L	2373	2316	1993	1670	1471	1367	1329	1291	1262	1224					
	316	2847	2847	2714	2657	2610	2600	2591	2581	2562	2524	2505	2429	2297	2126	1851
	316L	2373	2373	2202	1822	1670	1537	1490	1433	1376	1338					
	20Cb-3	3416	3189	3082	3022	2946	2839	2794	2748	2703	2657					
1" SCH 80	304	4952	4397	3962	3605	3301	3064	2958	2852	2747	2641	2562	2483	2403	2324	2245
	304L	4120	4041	3460	2905	2562	2377	2311	2245	2192	2139					
	316	4952	4952	4727	4622	4543	4516	4503	4490	4463	4424	4358	4226	3988	3697	3222
	316L	4120	4120	3829	3169	2905	2681	2588	2496	2403	2324					
	20Cb-3	5942	5546	5361	5256	5124	4939	4859	4780	4701	4622					
1¼" SCH 5	304	1059	939	848	770	706	657	636	611	586	565	547	526	516	498	480
	304L	883	862	742	622	547	509	494	480	470	456					
	316	1059	1059	1010	989	971	968	964	961	954	939	932	904	855	791	689
	316L	883	883	819	678	622	572	554	533	512	498					
	20Cb-3	1271	1187	1147	1124	1096	1057	1040	1023	1006	989					
1¼"SCH 10	304	1799	1595	1439	1307	1199	1115	1079	1037	995	959	929	893	875	845	815
	304L	1499	1463	1259	1055	929	863	839	815	797	773					
	316	1799	1799	1715	1679	1649	1643	1637	1631	1619	1595	1583	1535	1451	1343	1169
	316L	1499	1499	1391	1151	1055	971	941	905	869	845					
	20Cb-3	2158	2014	1947	1909	1861	1794	1765	1736	1707	1679					

(1)Code case 1188-4 stipulates minimum temperature of −20°F for Alloy 20Cb-3

ALLOWABLE INTERNAL WORKING PRESSURE (psig)

SCH 5, 10, 40 Welded Stainless Steel Pipe ASTM - A312 (Alloy 20Cb-3 ASTM-B464)
SCH 80 Seamless Stainless Steel Pipe ASTM - A312 (Alloy 20Cb-3 ASTM-B464)

	TYPE	METAL TEMPERATURE - DEGREES F														
		–425(1) to 100	200	300	400	500	600	650	700	750	800	850	900	950	1000	1050
1¼" SCH 40	304	2343	2077	1874	1703	1562	1453	1406	1351	1296	1250	1211	1164	1140	1101	1062
	304L	1953	1906	1640	1375	1211	1125	1093	1062	1039	1007					
	316	2343	2343	2234	2187	2148	2140	2132	2124	2109	2077	2062	1999	1890	1749	1523
	316L	1953	1953	1812	1500	1375	1265	1226	1179	1132	1101					
	20Cb-3	2812	2624	2537	2487	2424	2337	2299	2262	2224	2187					
1¼" SCH 80	304	4104	3645	3284	2988	2736	2539	2452	2364	2277	2189	2123	2058	1992	1926	1861
	304L	3415	3349	2868	2408	2123	1970	1915	1861	1817	1773					
	316	4104	4104	3918	3831	3765	3743	3732	3721	3699	3667	3612	3502	3305	3065	2671
	316L	3415	3415	3174	2627	2408	2221	2145	2069	1992	1926					
	20Cb-3	4925	4597	4444	4356	4247	4093	4028	3962	3896	3831					
1½" SCH 5	304	922	818	738	670	615	572	553	532	510	492	477	458	449	434	418
	304L	769	750	646	541	477	443	430	418	409	397					
	316	922	922	879	861	845	842	839	836	830	818	812	787	744	689	600
	316L	769	769	713	590	541	498	483	464	446	434					
	20Cb-3	1107	1033	999	979	954	920	905	890	876	861					
1½" SCH 10	304	1563	1386	1250	1136	1042	970	938	901	865	834	808	776	761	735	709
	304L	1303	1271	1094	917	808	750	729	709	693	672					
	316	1563	1563	1490	1459	1433	1428	1422	1417	1407	1386	1375	1334	1261	1167	1016
	316L	1303	1303	1209	1000	917	844	818	787	755	735					
	20Cb-3	1876	1751	1692	1659	1617	1559	1534	1509	1484	1459					
1½" SCH 40	304	2120	1879	1696	1540	1413	1314	1272	1222	1173	1130	1095	1053	1031	996	961
	304L	1766	1724	1484	1243	1095	1017	989	961	940	911					
	316	2120	2120	2021	1978	1943	1936	1929	1922	1908	1879	1865	1809	1710	1583	1378
	316L	1766	1766	1639	1356	1243	1145	1109	1067	1024	996					
	20Cb-3	2543	2374	2295	2249	2193	2114	2080	2046	2012	1978					
1½" SCH 80	304	3729	3312	2984	2715	2486	2307	2228	2148	2069	1989	1929	1870	1810	1750	1691
	304L	3103	3043	2606	2188	1929	1790	1740	1691	1651	1611					
	316	3729	3729	3560	3481	3421	3401	3391	3381	3361	3332	3282	3182	3003	2785	2427
	316L	3103	3103	2884	2387	2188	2019	1949	1880	1810	1750					
	20Cb-3	4475	4177	4038	3958	3859	3719	3660	3600	3540	3481					
2" SCH 5	304	734	651	587	534	490	455	441	423	406	392	379	365	357	345	333
	304L	612	597	514	431	379	352	343	333	326	316					
	316	734	734	700	685	673	671	668	666	661	651	646	627	592	548	477
	316L	612	612	568	470	431	396	384	370	355	345					
	20Cb-3	881	822	795	779	760	732	721	709	697	685					
2" SCH 10	304	1240	1099	992	901	826	769	744	715	686	661	640	616	603	583	562
	304L	1033	1008	868	727	640	595	578	562	550	533					
	316	1240	1240	1182	1157	1136	1132	1128	1124	1116	1099	1091	1058	1000	926	806
	316L	1033	1033	959	793	727	669	649	624	599	583					
	20Cb-3	1486	1388	1342	1316	1283	1236	1216	1197	1177	1157					
2" SCH 40	304	1787	1584	1429	1298	1191	1108	1072	1030	989	953	923	887	869	840	810
	304L	1489	1453	1251	1048	923	858	834	810	792	768					
	316	1787	1787	1703	1667	1638	1632	1626	1620	1608	1584	1572	1524	1441	1334	1161
	316L	1489	1489	1382	1143	1048	965	935	899	863	840					
	20Cb-3	2144	2001	1934	1896	1848	1782	1753	1725	1696	1667					
2" SCH 80	304	3223	2862	2579	2346	2149	1994	1925	1857	1788	1719	1667	1616	1564	1513	1461
	304L	2682	2630	2252	1891	1667	1547	1504	1461	1427	1392					
	316	3223	3223	3077	3008	2957	2939	2931	2922	2905	2879	2836	2750	2596	2407	2097
	316L	2682	2682	2493	2063	1891	1745	1685	1624	1564	1513					
	20Cb-3	3868	3610	3490	3421	3335	3215	3163	3111	3060	3008					
2½" SCH 5	304	777	689	622	565	518	482	466	448	430	415	402	386	378	365	352
	304L	648	632	544	456	402	373	363	352	345	334					
	316	777	777	741	726	713	710	707	705	700	689	684	663	627	580	505
	316L	648	648	601	498	456	420	407	391	376	365					
	20Cb-3	933	871	842	825	804	775	763	750	738	726					

(1)Code case 1188-4 stipulates minimum temperature of –20°F for Alloy 20Cb-3

Listings continued on next page.

ALLOWABLE INTERNAL WORKING PRESSURE (psig)

SCH 5, 10, 40 Welded Stainless Steel Pipe ASTM - A312 (Alloy 20Cb-3 ASTM-B464)
SCH 80 Seamless Stainless Steel Pipe ASTM - A312 (Alloy 20Cb-3 ASTM-B464)

	TYPE	METAL TEMPERATURE - DEGREES F														
		−425(1) to 100	200	300	400	500	600	650	700	750	800	850	900	950	1000	1050
2½" SCH 10	304	1129	1001	903	820	752	700	677	651	624	602	583	561	549	530	512
	304L	941	918	790	662	583	542	527	512	500	485					
	316	1129	1129	1076	1053	1035	1031	1027	1023	1016	1001	993	963	910	843	734
	316L	941	941	873	722	662	609	591	568	545	530					
	20Cb-3	1354	1264	1222	1198	1168	1126	1108	1089	1071	1053					
2½" SCH 40	304	1953	1732	1562	1419	1302	1211	1172	1126	1081	1042	1009	970	950	918	885
	304L	1628	1588	1367	1146	1009	937	911	885	866	840					
	316	1953	1953	1862	1823	1790	1784	1777	1771	1758	1732	1719	1667	1575	1458	1269
	316L	1628	1628	1510	1250	1146	1055	1022	983	944	918					
	20Cb-3	2344	2187	2114	2073	2021	1948	1917	1885	1854	1823					
2½" SCH 80	304	3384	3005	2708	2464	2256	2094	2022	1949	1877	1805	1751	1697	1643	1588	1534
	304L	2816	2762	2365	1986	1751	1625	1579	1534	1498	1462					
	316	3384	3384	3231	3159	3105	3087	3078	3069	3050	3023	2978	2888	2726	2527	2202
	316L	2816	2816	2617	2166	1986	1832	1769	1706	1643	1588					
	20Cb-3	4061	3791	3664	3592	3502	3375	3321	3267	3213	3159					
3" SCH 5	304	636	564	509	462	424	395	382	367	352	339	329	316	310	299	288
	304L	530	518	445	373	329	305	297	288	282	274					
	316	636	636	607	594	583	581	579	577	573	564	560	543	513	475	414
	316L	530	530	492	407	373	344	333	320	308	299					
	20Cb-3	764	713	689	675	658	635	624	614	604	594					
3" SCH 10	304	922	818	738	670	615	572	553	532	510	492	476	458	449	433	418
	304L	768	750	645	541	476	443	430	418	409	396					
	316	922	922	879	861	845	842	839	836	830	818	811	787	744	688	599
	316L	768	768	713	590	541	498	483	464	446	433					
	20Cb-3	1106	1033	998	979	954	920	905	890	875	861					
3" SCH 40	304	1694	1502	1355	1231	1129	1050	1016	977	937	903	875	841	824	796	768
	304L	1411	1377	1185	994	875	813	790	768	751	728					
	316	1694	1694	1614	1581	1552	1547	1541	1535	1524	1502	1490	1445	1366	1264	1101
	316L	1411	1411	1310	1084	994	914	886	852	819	796					
	20Cb-3	2032	1897	1833	1797	1752	1689	1662	1635	1608	1581					
3" SCH 80	304	2987	2652	2390	2174	1991	1848	1784	1720	1657	1593	1545	1497	1450	1402	1354
	304L	2485	2437	2087	1752	1545	1434	1394	1354	1322	1290					
	316	2987	2987	2851	2788	2740	2724	2716	2708	2692	2668	2628	2549	2405	2230	1943
	316L	2485	2485	2310	1912	1752	1617	1561	1505	1450	1402					
	20Cb-3	3584	3345	3234	3170	3090	2979	2931	2883	2836	2788					
4" SCH 5	304	493	437	394	358	329	306	296	284	273	263	255	245	240	232	224
	304L	411	401	345	289	255	237	230	224	219	212					
	316	493	493	470	460	452	450	449	447	444	437	434	421	398	368	320
	316L	411	411	381	316	289	266	258	248	238	232					
	20Cb-3	592	552	534	523	510	492	484	476	468	460					
4" SCH 10	304	713	632	571	518	476	442	428	411	395	380	369	354	347	335	323
	304L	594	580	499	418	369	342	333	323	316	307					
	316	713	713	680	666	654	651	649	647	642	632	628	609	575	533	464
	316L	594	594	552	456	418	385	373	359	345	335					
	20Cb-3	856	799	772	757	738	711	700	689	677	666					
4" SCH 40	304	1433	1270	1146	1041	955	888	860	826	793	764	740	712	697	673	650
	304L	1194	1165	1003	841	740	688	669	650	635	616					
	316	1433	1433	1366	1337	1313	1309	1304	1299	1290	1270	1261	1223	1156	1070	931
	316L	1194	1194	1108	917	841	774	750	721	693	673					
	20Cb-3	1719	1605	1551	1521	1482	1429	1406	1383	1360	1337					
4" SCH 80	304	2595	2304	2076	1889	1730	1605	1550	1495	1439	1384	1342	1301	1259	1218	1176
	304L	2159	2118	1813	1522	1342	1246	1211	1176	1149	1121					
	316	2595	2595	2477	2422	2380	2367	2360	2353	2339	2318	2284	2214	2090	1938	1688
	316L	2159	2159	2007	1661	1522	1405	1356	1308	1259	1218					
	20Cb-3	3114	2906	2810	2754	2685	2588	2547	2505	2464	2422					

(1)Code case 1188-4 stipulates minimum temperature of −20°F for Alloy 20Cb-3

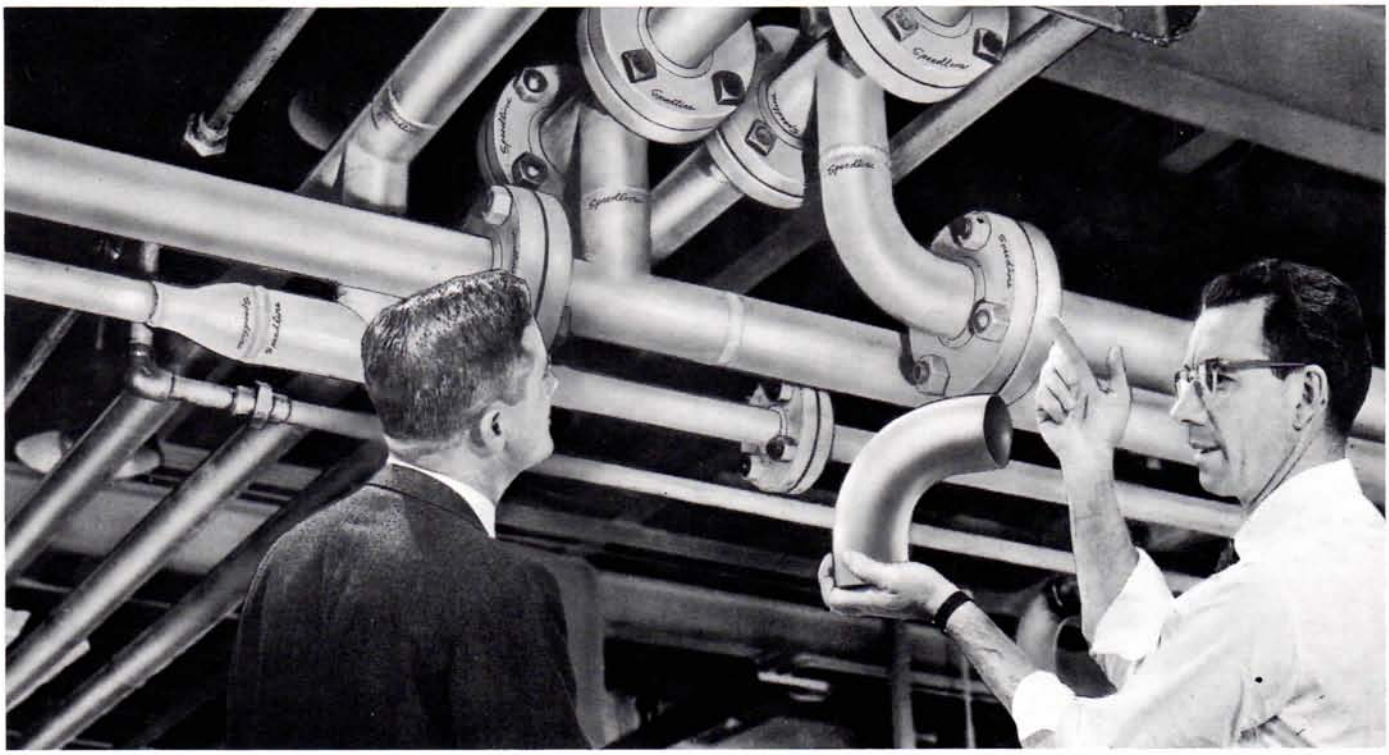
ALLOWABLE INTERNAL WORKING PRESSURE (psig)

SCH 5, 10, 40 Welded Stainless Steel Pipe ASTM - A312 (Alloy 20Cb-3 ASTM-B464)
SCH 80 Seamless Stainless Steel Pipe ASTM - A312 (Alloy 20Cb-3 ASTM-B464)

	TYPE	METAL TEMPERATURE - DEGREES F														
		−425(1) to 100	200	300	400	500	600	650	700	750	800	850	900	950	1000	1050
6" SCH 5	304	435	386	348	316	290	270	261	251	241	232	225	216	212	205	197
	304L	363	354	305	255	225	209	203	197	193	187					
	316	435	435	415	406	399	397	396	395	392	386	383	371	351	325	283
	316L	363	363	337	278	255	235	228	219	210	205					
	20Cb-3	522	487	471	462	450	434	427	420	413	406					
6" SCH 10	304	537	477	430	391	358	333	322	310	297	287	278	270	262	253	244
	304L	448	437	376	315	278	258	251	244	238	231					
	316	537	537	512	502	493	491	489	487	484	477	473	459	434	401	349
	316L	448	448	416	344	315	290	281	271	260	253					
	20Cb-3	645	602	582	570	556	536	527	519	510	502					
6" SCH 40	304	1143	1014	915	831	762	709	686	659	633	610	591	568	556	537	518
	304L	953	930	800	671	591	549	534	518	507	492					
	316	1143	1143	1090	1067	1048	1044	1040	1037	1029	1014	1006	976	922	854	743
	316L	953	953	884	732	671	617	598	575	553	537					
	20Cb-3	1372	1280	1238	1213	1183	1140	1122	1104	1085	1067					
6" SCH 80	304	2243	1991	1794	1633	1495	1387	1340	1292	1244	1196	1160	1124	1088	1052	1017
	304L	1866	1830	1567	1316	1160	1076	1047	1017	993	969					
	316	2243	2243	2141	2093	2057	2045	2039	2033	2021	2003	1973	1914	1806	1674	1459
	316L	1866	1866	1734	1435	1316	1214	1172	1130	1088	1052					
	20Cb-3	2691	2512	2428	2380	2320	2237	2201	2165	2129	2093					

(1)Code case 1188-4 stipulates minimum temperature of −20°F for Alloy 20Cb-3

INTERNAL WORKING PRESSURE LISTINGS ARE CONTINUED ON FOLLOWING PAGES
Aluminum Page 74
Monel, Nickel, Inconel Pages 75-76



THE *EXTRA LENGTH* FEATURE OF SPEEDLINE FITTINGS
ADDS COST-SAVING VERSATILITY TO PROCESS PIPING INSTALLATIONS

ALLOWABLE INTERNAL WORKING PRESSURE (psig)
Seamless Aluminum Pipe ASTM B241

(Welded figures are for seamless pipe after welding into system)

PIPE SIZE I.P.S.	GRADE	METAL TEMPERATURE – DEGREES F						
		−325 to 100	150	200	250	300	350	400
½" Sch 10	3003-H18	1260	1195	1130	1064	980	821	653
	3003-H112	672	607	560	523	467	411	355
	6061-T6	1774	1718	1680	1587	1344	1046	747
	6061-T6 Welded	1120	1102	1064	1008	934	784	597
	6063-T6	1400	1326	1270	1139	840	579	373
	6063-T6 Welded	793	784	747	709	672	513	355
½" Sch 40	3003-H18	1679	1592	1505	1418	1306	1094	870
	3003-H112	895	808	746	696	622	547	473
	6061-T6	2363	2288	2238	2114	1791	1393	995
	6061-T6 Welded	1492	1467	1418	1343	1244	1045	796
	6063-T6	1865	1766	1691	1517	1119	771	497
	6063-T6 Welded	1057	1045	995	945	895	684	473
¾" Sch 10	3003-H18	994	942	891	839	773	648	515
	3003-H112	530	478	442	412	368	324	280
	6061-T6	1398	1354	1325	1251	1060	824	589
	6061-T6 Welded	883	868	839	795	736	618	471
	6063-T6	1104	1045	1001	898	662	456	294
	6063-T6 Welded	626	618	589	559	530	405	280
¾" Sch 40	3003-H18	1376	1305	1234	1162	1070	897	714
	3003-H112	734	663	612	571	510	449	387
	6061-T6	1937	1876	1835	1733	1468	1142	816
	6061-T6 Welded	1223	1203	1162	1101	1020	856	652
	6063-T6	1529	1448	1387	1244	918	632	408
	6063-T6 Welded	867	856	816	775	734	561	387
1" Sch 10	3003-H18	1035	981	927	874	805	675	537
	3003-H112	552	498	460	429	383	337	291
	6061-T6	1456	1410	1380	1303	1104	858	613
	6061-T6 Welded	920	904	874	828	767	644	491
	6063-T6	1150	1088	1042	935	690	475	307
	6063-T6 Welded	652	644	613	583	552	422	291
1" Sch 40	3003-H18	1281	1215	1148	1082	996	835	664
	3003-H112	683	617	569	531	475	418	361
	6061-T6	1803	1746	1708	1613	1367	1063	759
	6061-T6 Welded	1139	1120	1082	1025	949	797	607
	6063-T6	1424	1348	1291	1158	854	588	380
	6063-T6 Welded	807	797	759	721	683	522	361
1¼" Sch 10	3003-H18	809	767	725	683	629	528	420
	3003-H112	432	390	360	336	300	264	228
	6061-T6	1139	1103	1079	1019	863	671	480
	6061-T6 Welded	719	707	683	647	600	504	384
	6063-T6	899	851	815	731	540	372	240
	6063-T6 Welded	510	504	480	456	432	330	228
1¼" Sch 40	3003-H18	1054	1000	945	890	820	687	547
	3003-H112	562	508	469	437	391	344	297
	6061-T6	1484	1437	1406	1328	1125	875	625
	6061-T6 Welded	937	922	890	843	781	656	500
	6063-T6	1172	1109	1062	953	703	484	312
	6063-T6 Welded	664	656	625	594	562	430	297
1½" Sch 10	3003-H18	703	667	630	594	547	458	365
	3003-H112	375	339	313	292	261	229	198
	6061-T6	990	959	938	886	750	584	417
	6061-T6 Welded	625	615	594	563	521	438	333
	6063-T6	782	740	709	636	469	323	208
	6063-T6 Welded	443	438	417	396	375	287	198
1½" Sch 40	3003-H18	954	904	855	805	742	622	495
	3003-H112	509	459	424	396	353	311	268
	6061-T6	1342	1300	1272	1201	1017	791	565
	6061-T6 Welded	848	834	805	763	707	593	452
	6063-T6	1060	1003	961	862	636	438	283
	6063-T6 Welded	601	593	565	537	509	389	268

PIPE SIZE I.P.S.	GRADE	METAL TEMPERATURE – DEGREES F						
		−325 to 100	150	200	250	300	350	400
2" Sch 10	3003-H18	558	529	500	471	434	364	289
	3003-H112	298	269	248	231	207	182	157
	6061-T6	785	760	745	702	595	463	331
	6061-T6 Welded	496	488	471	446	413	347	264
	6063-T6	620	587	562	504	372	256	165
	6063-T6 Welded	351	347	331	314	298	227	157
2" Sch 40	3003-H18	804	762	721	679	625	524	417
	3003-H112	429	387	357	333	298	262	226
	6061-T6	1131	1096	1072	1012	858	667	476
	6061-T6 Welded	715	703	679	643	596	500	381
	6063-T6	893	846	810	727	536	369	238
	6063-T6 Welded	506	500	476	453	429	328	226
2½" Sch 10	3003-H18	508	482	455	429	395	331	263
	3003-H112	271	245	226	211	188	166	143
	6061-T6	715	692	677	640	542	421	301
	6061-T6 Welded	451	444	429	406	376	316	241
	6063-T6	564	534	512	459	339	233	150
	6063-T6 Welded	320	316	301	286	271	207	143
2½" Sch 40	3003-H18	879	833	788	742	684	573	456
	3003-H112	469	423	391	365	326	286	247
	6061-T6	1237	1198	1172	1107	937	729	521
	6061-T6 Welded	781	768	742	703	651	547	417
	6063-T6	977	924	885	794	586	404	260
	6063-T6 Welded	553	547	521	495	469	358	247
3" Sch 10	3003-H18	415	393	372	350	323	270	215
	3003-H112	221	200	184	172	154	135	117
	6061-T6	584	566	553	522	443	344	246
	6061-T6 Welded	369	363	350	332	307	258	197
	6063-T6	461	436	418	375	277	191	123
	6063-T6 Welded	261	258	246	234	221	169	117
3" Sch 40	3003-H18	762	723	683	644	593	497	395
	3003-H112	406	367	339	316	282	248	215
	6061-T6	1073	1039	1016	960	813	632	452
	6061-T6 Welded	677	666	644	610	565	474	361
	6063-T6	847	802	768	689	508	350	226
	6063-T6 Welded	480	474	452	429	406	310	215
4" Sch 10	3003-H18	321	304	288	271	250	209	166
	3003-H112	171	155	143	133	119	105	90
	6061-T6	452	437	428	404	342	266	190
	6061-T6 Welded	285	281	271	257	238	200	152
	6063-T6	357	338	323	200	214	147	95
	6063-T6 Welded	202	200	190	181	171	131	90
4" Sch 40	3003-H18	645	611	578	544	501	420	334
	3003-H112	344	310	287	267	239	210	181
	6061-T6	907	879	860	812	688	535	382
	6061-T6 Welded	573	564	544	516	478	401	306
	6063-T6	716	678	650	583	430	296	191
	6063-T6 Welded	406	401	382	363	344	263	181
6" Sch 10	3003-H18	242	229	217	204	188	158	125
	3003-H112	129	116	107	100	90	79	68
	6061-T6	340	330	322	305	258	201	143
	6061-T6 Welded	215	211	204	193	179	150	115
	6063-T6	269	254	244	219	161	111	72
	6063-T6 Welded	152	150	143	136	129	99	68
6" Sch 40	3003-H18	514	488	461	434	400	335	267
	3003-H112	274	248	229	213	191	168	145
	6061-T6	724	701	686	648	549	427	305
	6061-T6 Welded	457	450	434	412	381	320	244
	6063-T6	572	541	518	465	343	236	152
	6063-T6 Welded	324	320	305	290	274	210	145

ALLOWABLE INTERNAL WORKING PRESSURE (psig)

Seamless Nickel and Nickel Base Alloy Pipe - ASTM B161, B165 and B167
(Nickel 200 – Monel 400 – Inconel 600)

Pipe Size I.P.S.	GRADE	METAL TEMPERATURE – DEGREES F																
		−325 to 100	150	200	250	300	350	400	450	500	550	600	650	700	750	800	850	900
½" SCH 10	Nickel	1867	1867	1867	1867	1867	1867	1867	1867	1867	1867							
	Monel	3267	3174	3081	2987	2894	2819	2763	2744	2744	2744	2744	2744	2744	2735	2707	2334	1494
	Inconel	3734	3603	3473	3398	3361	3361	3361	3361	3361	3361	3361	3323	3267	3221	3174	3099	2987
½" SCH 40	Nickel	2487	2487	2487	2487	2487	2487	2487	2487	2487	2487							
	Monel	4352	4228	4104	3979	3855	3755	3681	3656	3656	3656	3656	3656	3656	3643	3606	3109	1990
	Inconel	4974	4800	4626	4526	4477	4477	4477	4477	4477	4477	4477	4427	4352	4290	4228	4128	3979
¾" SCH 10	Nickel	1472	1472	1472	1472	1472	1472	1472	1472	1472	1472							
	Monel	2576	2504	2429	2355	2282	2223	2179	2164	2164	2164	2164	2164	2164	2156	2134	1840	1178
	Inconel	2944	2841	2738	2679	2650	2650	2650	2650	2650	2650	2650	2620	2576	2539	2504	2444	2355
¾" SCH 40	Nickel	2039	2039	2039	2039	2039	2039	2039	2039	2039	2039							
	Monel	3568	3466	3364	3262	3160	3079	3018	2997	2997	2997	2997	2997	2997	2987	2957	2549	1631
	Inconel	4078	3935	3793	3711	3670	3670	3670	3670	3670	3670	3670	3629	3568	3517	3466	3385	3262
1" SCH 10	Nickel	1533	1533	1533	1533	1533	1533	1533	1533	1533	1533							
	Monel	2683	2606	2529	2453	2376	2315	2269	2254	2254	2254	2254	2254	2254	2246	2223	1916	1226
	Inconel	3066	2959	2851	2790	2759	2759	2759	2759	2759	2759	2759	2729	2683	2644	2606	2545	2453
1" SCH 40	Nickel	1898	1898	1898	1898	1898	1898	1898	1898	1898	1898							
	Monel	3322	3227	3132	3037	2942	2866	2809	2790	2790	2790	2790	2790	2790	2781	2752	2373	1518
	Inconel	3796	3663	3530	3454	3416	3416	3416	3416	3416	3416	3416	3378	3322	3274	3227	3151	3037
1¼" SCH 10	Nickel	1199	1199	1199	1199	1199	1199	1199	1199	1199	1199							
	Monel	2098	2038	1978	1918	1858	1810	1775	1763	1763	1763	1763	1763	1763	1757	1739	1499	959
	Inconel	2398	2314	2230	2182	2158	2158	2158	2158	2158	2158	2158	2134	2098	2068	2038	1990	1918
1¼" SCH 40	Nickel	1562	1562	1562	1562	1562	1562	1562	1562	1562	1562							
	Monel	2734	2655	2577	2499	2421	2359	2312	2296	2296	2296	2296	2296	2296	2288	2265	1953	1250
	Inconel	3124	3015	2905	2843	2812	2812	2812	2812	2812	2812	2812	2780	2734	2694	2655	2593	2499
1½" SCH 10	Nickel	1042	1042	1042	1042	1042	1042	1042	1042	1042	1042							
	Monel	1824	1771	1719	1667	1615	1573	1542	1532	1532	1532	1532	1532	1532	1527	1571	1303	834
	Inconel	2084	2011	1938	1896	1876	1876	1876	1876	1876	1876	1876	1856	1824	1797	1771	1730	1667
1½" SCH 40	Nickel	1413	1413	1413	1413	1413	1413	1413	1413	1413	1413							
	Monel	2473	2402	2331	2261	2190	2134	2091	2077	2077	2077	2077	2077	2077	2070	2049	1766	1130
	Inconel	2826	2727	2628	2572	2543	2543	2543	2543	2543	2543	2543	2543	2473	2437	2402	2346	2261
2" SCH 10	Nickel	826	826	826	826	826	826	826	826	826	826							
	Monel	1446	1405	1364	1322	1281	1248	1223	1215	1215	1215	1215	1215	1215	1211	1198	1033	661
	Inconel	1653	1595	1537	1504	1488	1488	1488	1488	1488	1488	1488	1471	1446	1426	1405	1372	1322
2" SCH 40	Nickel	1191	1191	1191	1191	1191	1191	1191	1191	1191	1191							
	Monel	2084	2025	1965	1906	1846	1798	1763	1751	1751	1751	1751	1751	1751	1745	1727	1489	953
	Inconel	2382	2299	2215	2168	2144	2144	2144	2144	2144	2144	2144	2120	2084	2054	2025	1977	1906
2½" SCH 10	Nickel	752	752	752	752	752	752	752	752	752	752							
	Monel	1317	1279	1241	1204	1166	1136	1114	1106	1106	1106	1106	1106	1106	1102	1091	941	602
	Inconel	1505	1452	1399	1369	1354	1354	1354	1354	1354	1354	1354	1339	1317	1298	1279	1249	1204
2½" SCH 40	Nickel	1302	1302	1302	1302	1302	1302	1302	1302	1302	1302							
	Monel	2279	2213	2148	2083	2018	1966	1927	1914	1914	1914	1914	1914	1914	1907	1888	1628	1041
	Inconel	2604	2513	2422	2370	2344	2344	2344	2344	2344	2344	2344	2318	2279	2246	2213	2161	2083
3" SCH 10	Nickel	615	615	615	615	615	615	615	615	615	615							
	Monel	1076	1045	1014	984	953	928	910	904	904	904	904	904	904	901	891•	768	492
	Inconel	1229	1186	1143	1119	1106	1106	1106	1106	1106	1106	1106	1094	1076	1060	1045	1020	984
3" SCH 40	Nickel	1129	1129	1129	1129	1129	1129	1129	1129	1129	1129							
	Monel	1976	1919	1863	1806	1750	1705	1671	1660	1660	1660	1660	1660	1660	1654	1637	1411	903
	Inconel	2258	2179	2100	2055	2032	2032	2032	2032	2032	2032	2032	2010	1976	1948	1919	1874	1806

Listings continued on next page.

ALLOWABLE INTERNAL WORKING PRESSURE (psig)

Seamless Nickel and Nickel Base Alloy Pipe - ASTM B161, B165 and B167
(Nickel 200 – Monel 400 – Inconel 600)

Pipe Size I.P.S.	GRADE	METAL TEMPERATURE – DEGREES F																
		–325 to 100	150	200	250	300	350	400	450	500	550	600	650	700	750	800	850	900
4" SCH 10	Nickel	476	476	476	476	476	476	476	476	476	476							
	Monel	832	808	785	761	737	718	704	699	699	699	699	699	699	697	689	594	380
	Inconel	951	918	884	865	856	856	856	856	856	856	856	846	832	820	808	789	761
4" SCH 40	Nickel	955	955	955	955	955	955	955	955	955	955							
	Monel	1672	1624	1576	1528	1481	1442	1414	1404	1404	1404	1404	1404	1404	1399	1385	1194	764
	Inconel	1910	1844	1777	1738	1719	1719	1719	1719	1719	1719	1719	1700	1672	1648	1624	1586	1528
6" SCH 10	Nickel	287	287	287	287	287	287	287	287	287	287							
	Monel	595	559	523	505	487	480	473	471	469	469	469	469	469	469	469	376	287
	Inconel	595	588	580	570	559	554	548	543	537	536	534	530	527	520	516	507	498
6" SCH 10	Nickel	610	610	610	610	610	610	610	610	610	610							
	Monel	1265	1189	1113	1075	1037	1021	1006	1002	998	998	998	998	998	998	998	800	610
	Inconel	1265	1250	1235	1212	1189	1178	1166	1155	1143	1139	1136	1128	1120	1105	1098	1079	1059

STAINLESS STEEL PIPE LINES

ALLOWABLE SPAN AND DRAINAGE

The allowable span of a pipe line is affected by many factors, such as:

1. Stresses which have been proved safe in various alloys at various working temperatures.
2. Dimensions of cross section of pipe, usually expressed in Section Modulus.
3. Bending force, including weights of metal pipe, fluid or gas carried, insulation and weatherproofing, together with lateral forces such as wind load. Included, also, should be non-uniform loads such as flanges, valves, fittings or branch lines between supports.

The following charts are offered as a means of establishing quickly the answers to a few hundred of the more likely combinations of these factors. **Chart answers are each limited to the specific conditions stated thereon and supplemented under Specifications below.** Innumerable additional possible variations to the chart answers are covered under the following sections on Variations.

SPAN EQUATION

For the user who may be interested in the basis of the chart figures in order that he may adapt them to some special use, the fundamental equation for the chart is:

$$L = C\sqrt{\frac{SZ}{W}}$$

Where:

L = Length of span in feet, shown at bottom of charts.

C = Constant: Intermediate between "free" span and "continuous" beam. Derived from standard beam formulae at 25% of Code Stress as apportioned to bend-load. Here C = .447.

S = Stress recommended by governing code: ASA B31.3-1966.

Z = Section modulus of pipe, calculable from ASA B36.19-1965.

W = Weight or resultant force in lbs. per foot of pipe line in operation, including metal, fluid, insulation, weatherproofing and wind.

The spacing of temperature lines does not follow a smooth logarithmic sequence, nor does one set of curves appear to be exactly consistent with another. This probably is due to the cumulative effect of weights and wind combined with arbitrarily chosen points to shift from one commercial thickness of insulation to another.

SPECIFICATIONS

Pipe, dimensions; outside diameter and wall thickness; ASA Code B36.19-1965 "American Standard for Stainless Steel Pipe." Table I.

Pipe, allowable stresses; ASA Code B31.3-1966 "Code for Pressure Piping—Petroleum Refinery Piping" Appendix A Electric Fusion Welded Pipe—TP 304 ASTM A-312.

Insulation; a conservative composite of current practices. The weight is assumed at 20# per cu. ft. gross, plus weatherproofing. Latter assumed as 2 plies of 30# roofing felt.

Wind; 25# per square foot of projected area.

Span; intermediate between pure "free" span and pure "continuous" beam.

Fluids; "Air, Gas and Vapor Lines"; calculated as empty pipe. "Liquid Lines"; liquid same weight as cold water (62.42#/cu. ft.).

Corrosion; assumed none.

Expansion Stress; assumed free of stress.

Concentrated Loads; valves, fittings, flanges, are not included in chart figures.

Gas Line Testing; no provision on charts for overload by bending due to weight of water during hydrostatic test.

VARIATIONS

Having set up a system for solution of a typical group of problems, the question immediately arises as to how much range of variation there will be in allowable span, if one or more of the factors is changed. If large amounts of money be involved, a complete recalculation may be justified. The outline for this is given above under the heading of SPAN EQUATION. For most cases a judgment factor applied to the chart answer will be adequate. For instance, to follow the order of the preceding SPECIFICATIONS—

Pipe Dimensions

For odd size tubing interpolate between nearest pipe sizes and weights shown.

Pipe Allowable Stresses

These may be varied by:

(a) Type of seam affects allowable span, thus: Seamless Pipe—apply factor 112%.

(b) **Alloy,** for the various alloys shown in Appendix A, ASA B31.3-1966 Electric Fusion Welded Pipe, the appropriate stresses are noted therein. Type 316 is something of a premium grade and, at 100°F, is no stronger than Type 304. However, at 1500°F, Type 316 is about twice as strong. Hence, an allowable span factor of 140% of that shown on the accompanying charts is appropriate for Type 316 at 1500°F. Premium alloys are sometimes used to avoid contamination of product. Also, they sometimes have lower corrosion rates for selected services, thus maintaining their physical

Text continued on page 82.

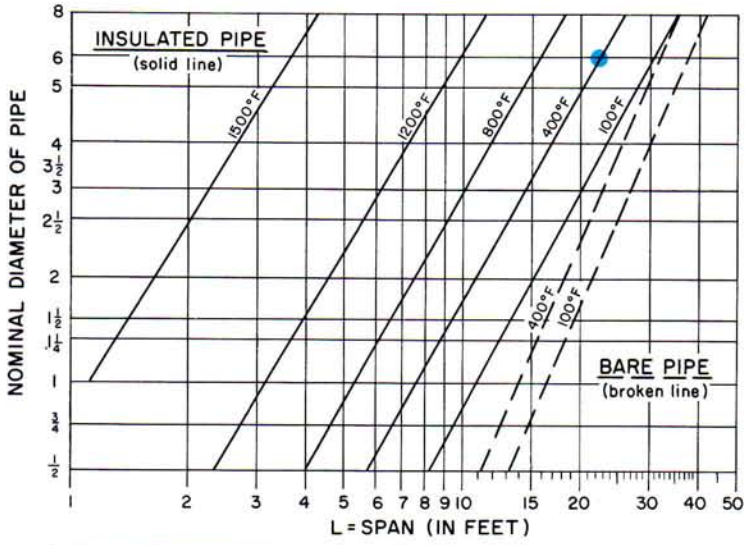
AIR, GAS or VAPOR LINES

INDOORS

Maximum Allowable Span Between Supports

SCHEDULE

5



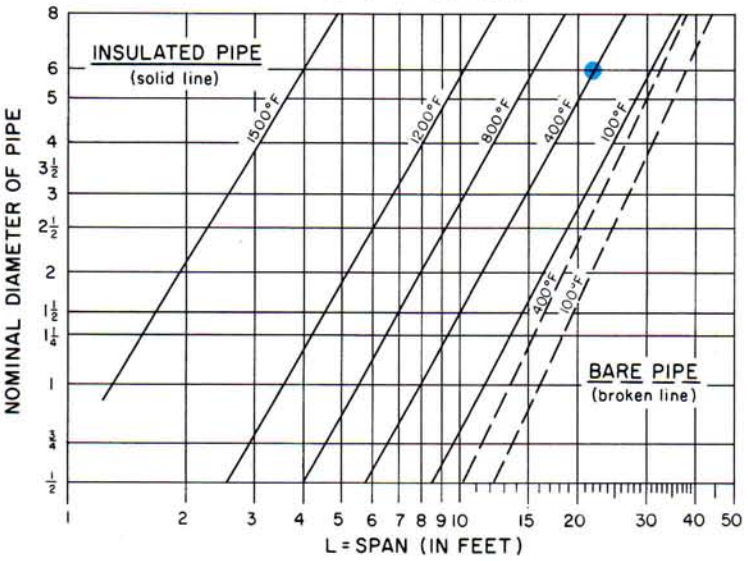
EXAMPLE:

Schedule 5 pipe, carrying air indoors, with insulated covering, temperature 400°F, diameter pipe 6" Read across 6" diameter coordinate to 400°F temperature line, then down to L

ANSWER: 22 ½ feet

SCHEDULE

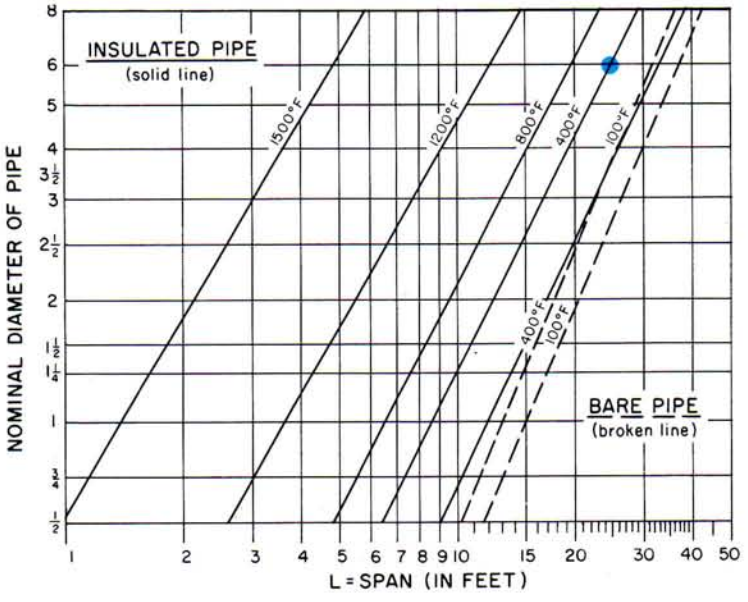
10



ANSWER: 22 feet

SCHEDULE

40



ANSWER: 25 feet

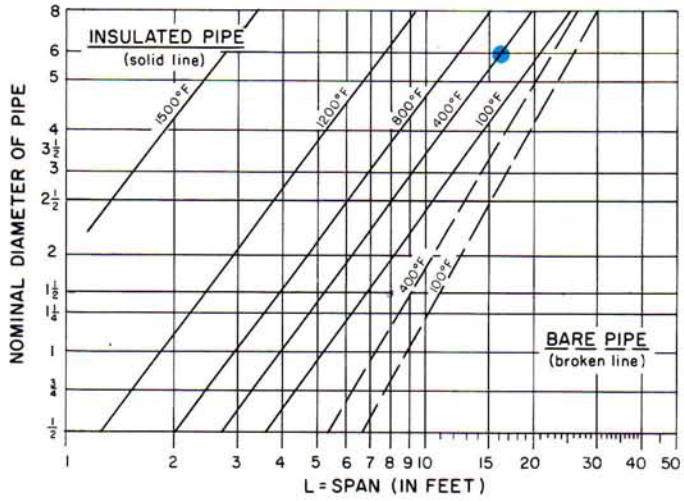
AIR, GAS or VAPOR LINES

OUTDOORS

Maximum Allowable Span Between Supports

SCHEDULE

5



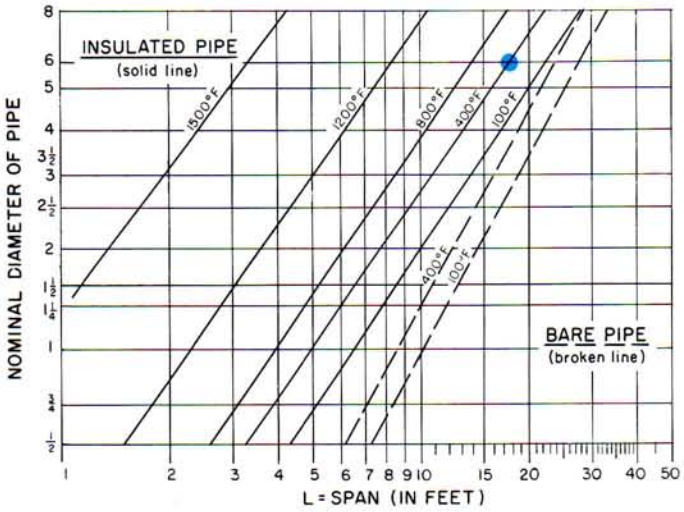
EXAMPLE:

Schedule 5 pipe, carrying air outdoors, with insulated covering, temperature 400°F, diameter pipe 6" Read across 6" diameter coordinate to 400°F temperature line, then down to L

ANSWER: 16 feet

SCHEDULE

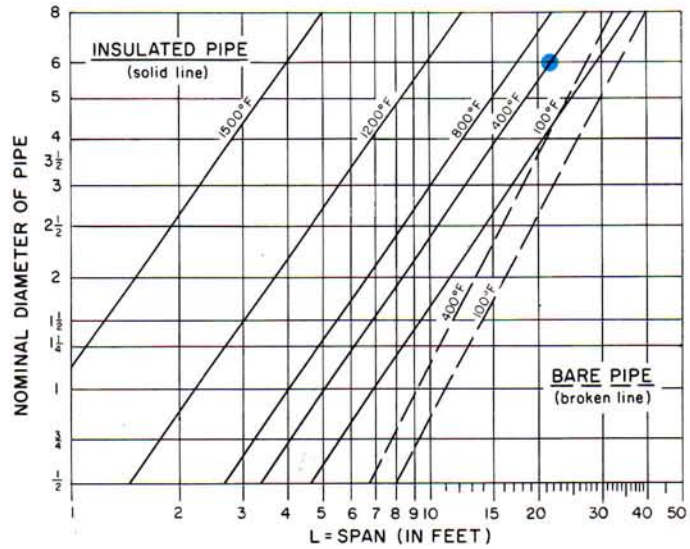
10



ANSWER: 18 feet

SCHEDULE

40



ANSWER: 22 feet

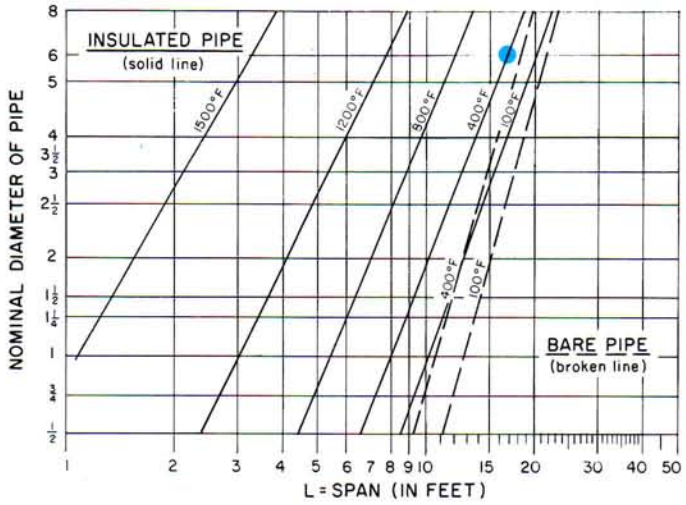
LIQUID FILLED LINES

INDOORS

Maximum Allowable Span Between Supports

SCHEDULE

5



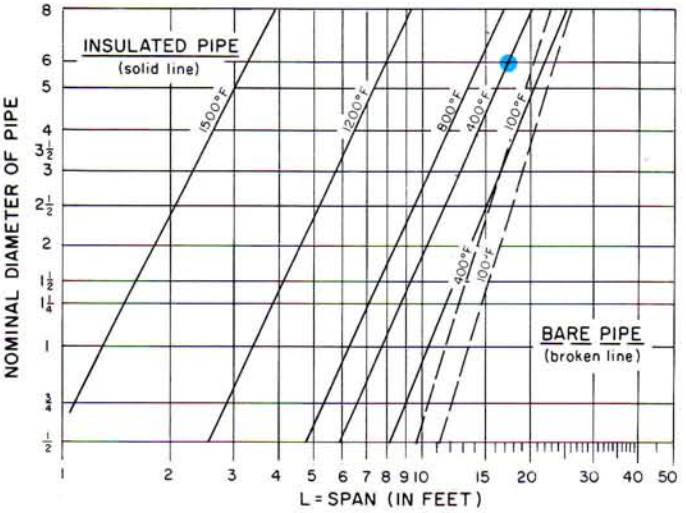
EXAMPLE:

Schedule 5 pipe, carrying liquid indoors, with insulated covering, temperature 400°F, diameter pipe 6" — Read across 6" diameter coordinate to 400°F temperature line, then down to L

ANSWER: 17 feet

SCHEDULE

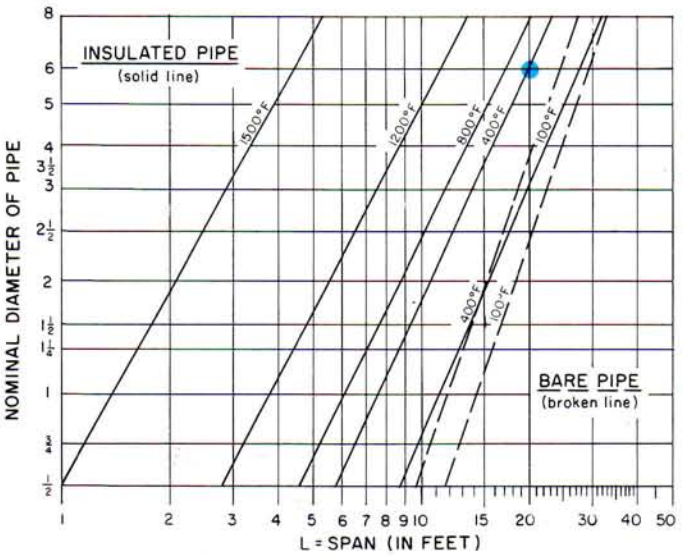
10



ANSWER: 17 feet

SCHEDULE

40



ANSWER: 20 feet

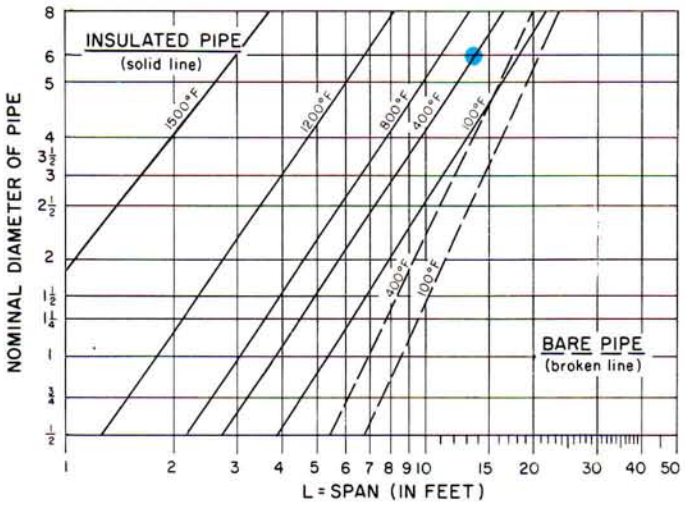
LIQUID FILLED LINES

OUTDOORS

Maximum Allowable Span Between Supports

SCHEDULE

5



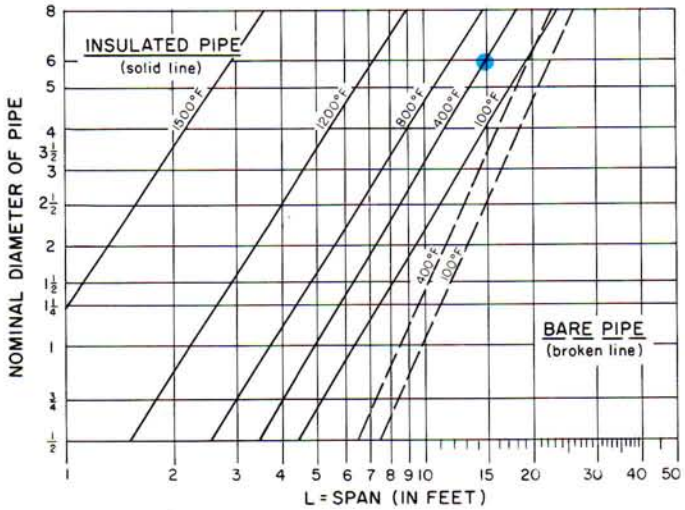
EXAMPLE:

Schedule 5 pipe, carrying liquid outdoors, with insulated covering, temperature 400°F, diameter pipe 6" — Read across 6" diameter coordinate to 400°F temperature line, then down to L

ANSWER: 13½ feet

SCHEDULE

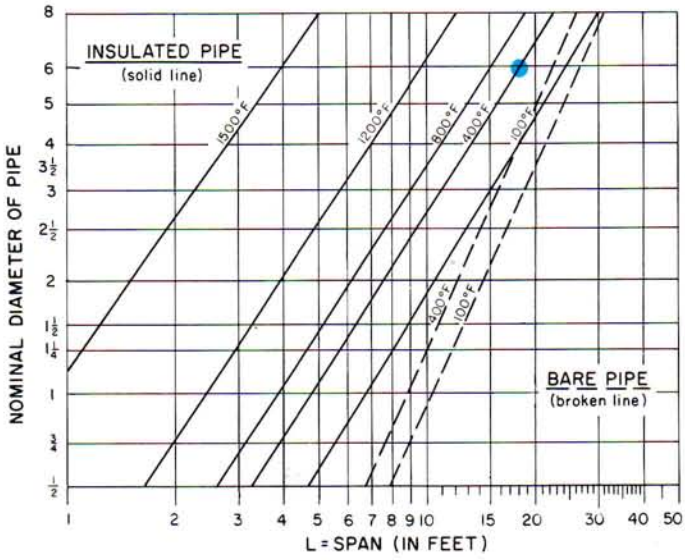
10



ANSWER: 15 feet

SCHEDULE

40



ANSWER: 18 feet

Continued from page 77.

strength against bursting or bending. The choice of supporting span would be on the basis of the chosen alloy after corrosion.

(c) **Codes.** Other codes are extant and still others are in preparation. In such cases, the allowable span will vary as the square root of the allowable stress.

Insulation

(a) **Density:** fibre glass insulation is sometimes used on lines at less than 350°F. It is much lighter. With gas lines at 350°F indoors this could increase the span on ½" pipe to about 116%, and on 8" pipe to 110%. The gain on outdoor liquid lines would be less.

(b) **Thickness:** The present range is from ⅞" on ½"–1" pipe at 100°F to 5" on 8" pipe at 1500°F. To modify this 30% might affect the smaller line, if gas, as much as 10%, or the larger line, if liquid, as little as 5% on the span. Again, the effect on outdoor lines would be less.

Beam

In the rare cases of pure "free" beam, the span would be 89% of the chart figure. Likewise, a pure "continuous" beam would stand 111% of the chart figure. Thus, in specific cases, a judgment factor may be applied within this range. In any case, the chart figure with such modifications as are discussed here is the maximum allowable span. It should not be exceeded without thorough study.

Fluids

Very few, if any, of the common gases or vapors are heavy enough to noticeably affect our problem. Most liquids fall within the range of 45 lbs. to 90 lbs./cu. ft. On bare Schedule 5 pipe, indoors, at 100°F, a slurry at 90#/cu. ft. would call for shorter span. On ½" pipe this would be 95% of the chart figure. On 8" pipe this would be 87% of the chart figure.

Conversely with a very light liquid at 30#/cu. ft. a longer span could be used. On ½" pipe this would be 103½% of the chart figure. On 8" pipe this would be 111% of the chart figure. On lines having thicker walls, insulation or wind load, the variation would be less.

Corrosion

Corrosion effects vary widely and call for detailed consideration in each instance. The usual corrosion allowance makes the pipe heavier at the start, meanwhile corrosion may be limited to the lower fibers, thus retaining most of the weight but greatly reducing the bending strength of the pipe. Furthermore, very heavy scale equal to the weight of all the metal is not uncommon.

In any case, the allowable span will be dictated by the strength of the pipe used, at the thickness expected at the end of its useful life. The most convincing approach is a successful precedent case, if it can be found. Meanwhile, pending better data, it would be uncommon to find need for spans shorter than half of those shown on the charts.

Expansion

On stainless pipe, this amounts to about 1¼" per 100 ft per 100°F temperature rise, increasing somewhat at higher temperatures. If the ends are not free to move apart this can result in buckling of straight pipe with bending stress already up to the allowance limit due to the beam action between pipe supports; thus added load could overstress the pipe and cause damage. In designing pipe supports and anchorage, provision for free longitudinal movement is imperative. Expansion joints or bends are sometimes necessary.

Concentrated Loads

Concentrated loads such as valves and fittings and their insulation can overstress a pipe line designed for full length spans. The remedy is to provide supports at the concentered load or alternately to shorten the affected span to compensate.

Gas Line Testing

Testing by hydrostatic method would probably cause permanent damage to lines larger than 1" if at full span. If this method of testing is imperative the allowable span should be not over 115% of the "Indoors, Liquid Line" at 100°F; i.e. a temporary load without wind or temperature penalty.

Condensate

Condensate in vapor lines is usually unimportant as a beam load, this, however, should be examined. If for any reason such as cold start up, large quantities of liquid will be present the approximate span should be chosen from "Liquid Line" charts.

Cumulative Results

At full value, all in one direction, these could have important effect on the final section of span. It is suggested that each variable be weighed objectively with the best data available plus engineering judgment and be combined thus.

(L final) = (L chart) x a x b x c x d, etc.

When L = maximum allowable span and a, b, c, d, etc. = % factors.

Then using—

(a) seamless pipe	112%
(b) weaker alloy	90%
(c) heavy liquid	95%
(d) close to free span	93%

(L final) = (L chart) x 1.12 x .90 x .95 x .93 = 89% x (L chart).

The safe span would then be limited to 89% of that shown on chart.

DRAINAGE

Having determined maximum safe span and thickness for a given pipe line, drainage can be a determining factor in the choice of pipe thickness.

Many pipe lines have to be drained at least occasionally. Air, gas or vapor lines may accumulate moisture which must be removed. Process liquid lines lying full and inactive may freeze, may allow

chemical deterioration of product or may permit settling of suspended solids which clog the line.

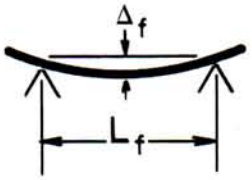
For light loads or infrequent needs, blowing with compressed air or steam is sometimes used. General practice calls for sloped lines draining by gravity to a take-off point such as a sump or a steam trap. Pump suction lines must often be sloped to avoid air pockets in the line which cause faulty pumping.

For a perfectly supported line with no sag and carrying a thin clean liquid ¼ or ½% incline should give a good drainage. For slurries and very thin paste 2% is often satisfactory. However, most lines are on spaced supports and the pipes sag between supports. Then the high end has to be raised enough to overcome this deflection in order to drain the low end of the span.

Four "Deflection" charts are provided herewith covering the most active part of the field. Deflections for other spans and lines may be calculated by the use of the formula shown thereon, for "free" span deflection.

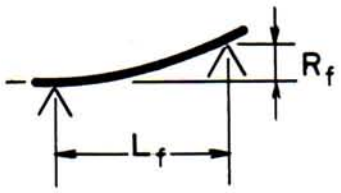
In most cases it is safe to assume that a loaded line will start to drain at the open down-hill end. This releases part of the liquid load. Then the elasticity of the pipe reduces the deflections to allow more flow, continuing until the pipe is almost empty. For the usual case then, drainage calculations are based on empty pipe.

The conservative assumption is a pipe in "free" span thus:



Deflection

One end must be raised to complete the drainage. It can be shown that in order to make the lower end of the pipe level on a "free" span the rise at the high end must be 4 times the deflection; hence:



Rise

$$R_f = 4\ \Delta_f$$

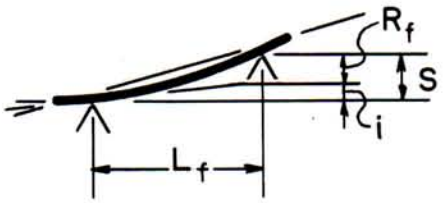
For maximum allowable "free" span the normal range of "Rise" is 1% to 2½% of span.

For "continuous" span the deflection is 1/5 that of "free" span and needs only 1/5 as much "Rise".

The end span deflections are intermediate cases between "free" and "continuous". Within this range a "judgment" factor may be applied; depending on the local detail.

To the Rise thus determined, add sufficient "incline" (¼% to 2% of span) as previously noted, to obtain clean drainage. The uphill support will be the distance R + i = s above the lower one.

Thus, for the purpose of this study:—



s = slope

Inches	Δ	= deflection	= bowing of the pipe due to elasticity.
"	R_f	= rise	= necessary lift to high end to make low end level.
"	i	= incline	= lift necessary to cause flow at low end.
"	s	= slope	= sum of R & i.
Feet	L	= length	= span between supports.

All of this sloping takes vertical space which may be at a premium under low ceilings, indoors, or with very long runs outdoors. The deflection varies as L square; hence, if we wish to reduce the deflection to half we get (the fourth root of .50 equaling 84%) i.e., the span may be shortened to 84% of the original length. If the liquid, then, is thin permitting modest incline at the low end, a saving of perhaps 40% in the slope per span is achieved.

"Deflections" Charts: Charts are provided covering the most active part of the stainless piping field.

They are developed for bare pipe, empty and full, at atmospheric temperature, comparing three weights of pipe, Schedules 5, 10 and 40. They are based on "free" spans, i.e., with ends free to move on their supports.

From these charts:

(1) Actual deflections may be read directly for these conditions.

(2) For lines loaded with insulation the increased deflection may be estimated to be in direct proportion to the increased weights.

(3) For longer spans the deflection will increase as the 4th power of the length of span. Thus for a span of 30 ft. we may readily find:— $(\frac{30'}{25'} = 1.2)^4$ equals 2.07 times the deflection for 25 feet.

(4) for "empty" bare pipes as for air or gas, the deflections are essentially equal.

"Deflections" Charts Formulae: For cases beyond the scope of the charts these formulae are noted here for the designers' convenience.

$$\Delta_f = \frac{5}{384} \quad \frac{W L^4 (12)^3}{E I}$$

$$\Delta_c = \frac{1}{384} \quad \frac{W L^4 (12)^3}{E I}$$

$$R_f = \frac{90 \quad W \ L^4}{E \ I}$$

$$R_c = \frac{18 \quad W \ L^4}{E \ I}$$

(See Deflection Charts . . . pages 85-86.)

When:—

Δ_f = Deflection on "free" span in inches

Δ_c = Deflection on "continuous" span in inches

R_f = Rise on "free" span in inches

R_c = Rise on "continuous" span in inches

W = Weight of piping in lbs. per lineal ft.

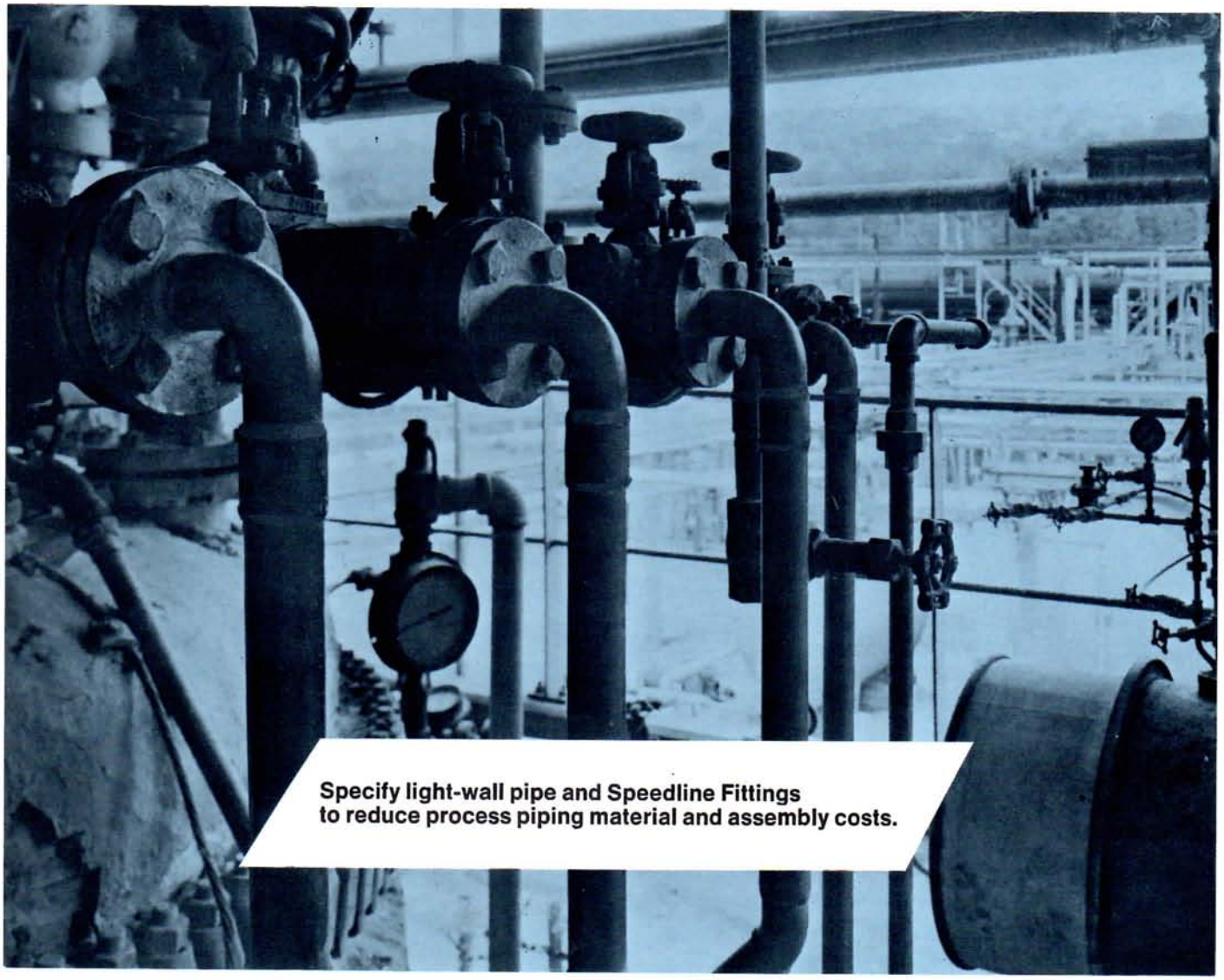
L = Length of span in feet

E = Modulus of elasticity
(28,000,000 for Type 304 @ 200°F.)
(23,400,000 for Type 304 @ 800°F.)

I = Moment of Inertia of pipe
(equals .049 $(D^4 - d^4)$ (in inches)^4

D = Diameter, outside pipe in inches

d = Diameter, inside pipe in inches



DEFLECTION ($\triangle_f$) ON *FREE* SPAN

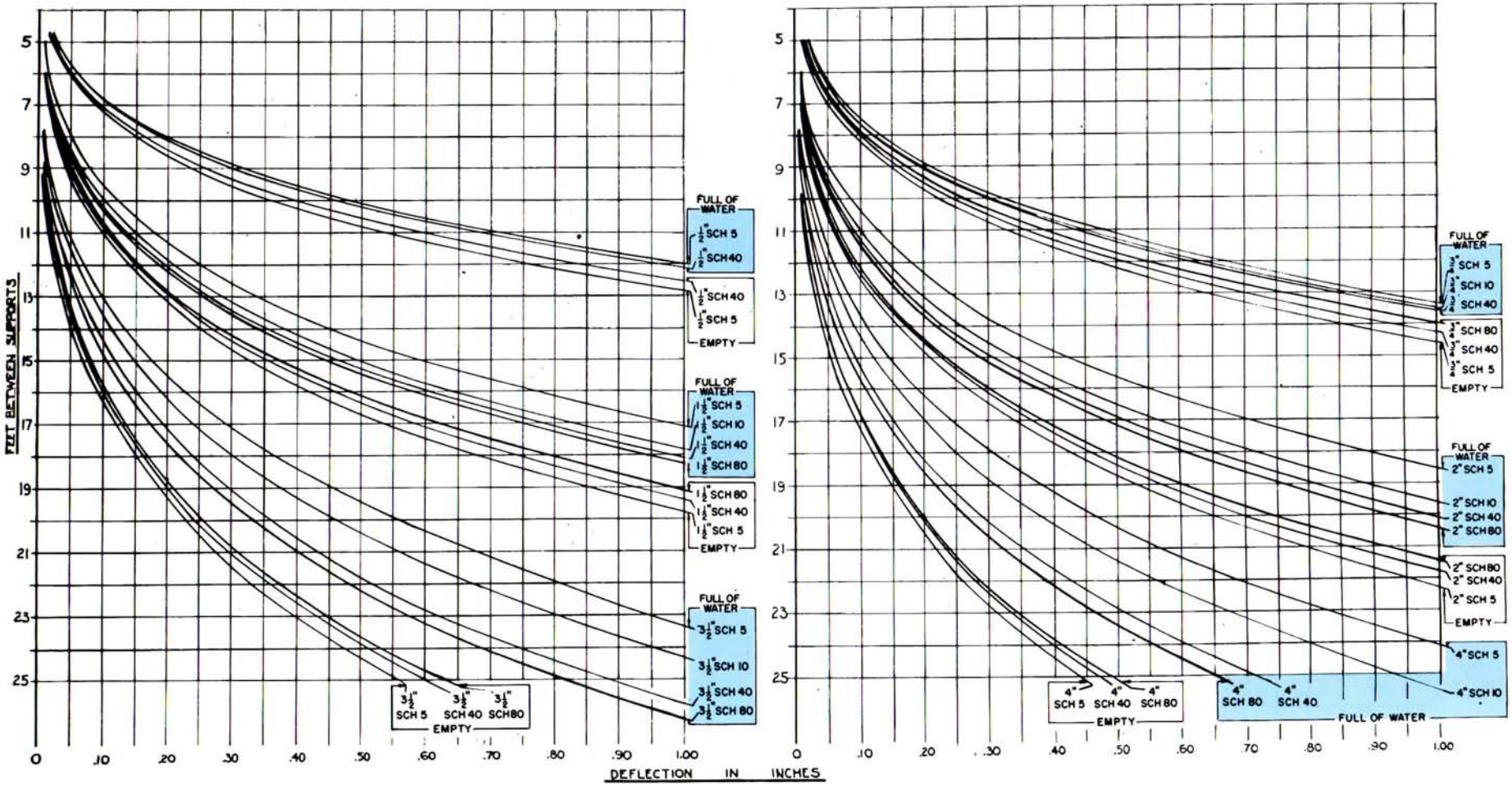


Chart A
½", 1½", 3½" Pipe Sizes

Chart B
¾", 2", 4" Pipe Sizes

For 1", 1¼", 2½", 3", 6", 8" Pipe Sizes see Charts C and D, page 86.

DEFLECTION ($\triangle_f$) ON *FREE* SPAN

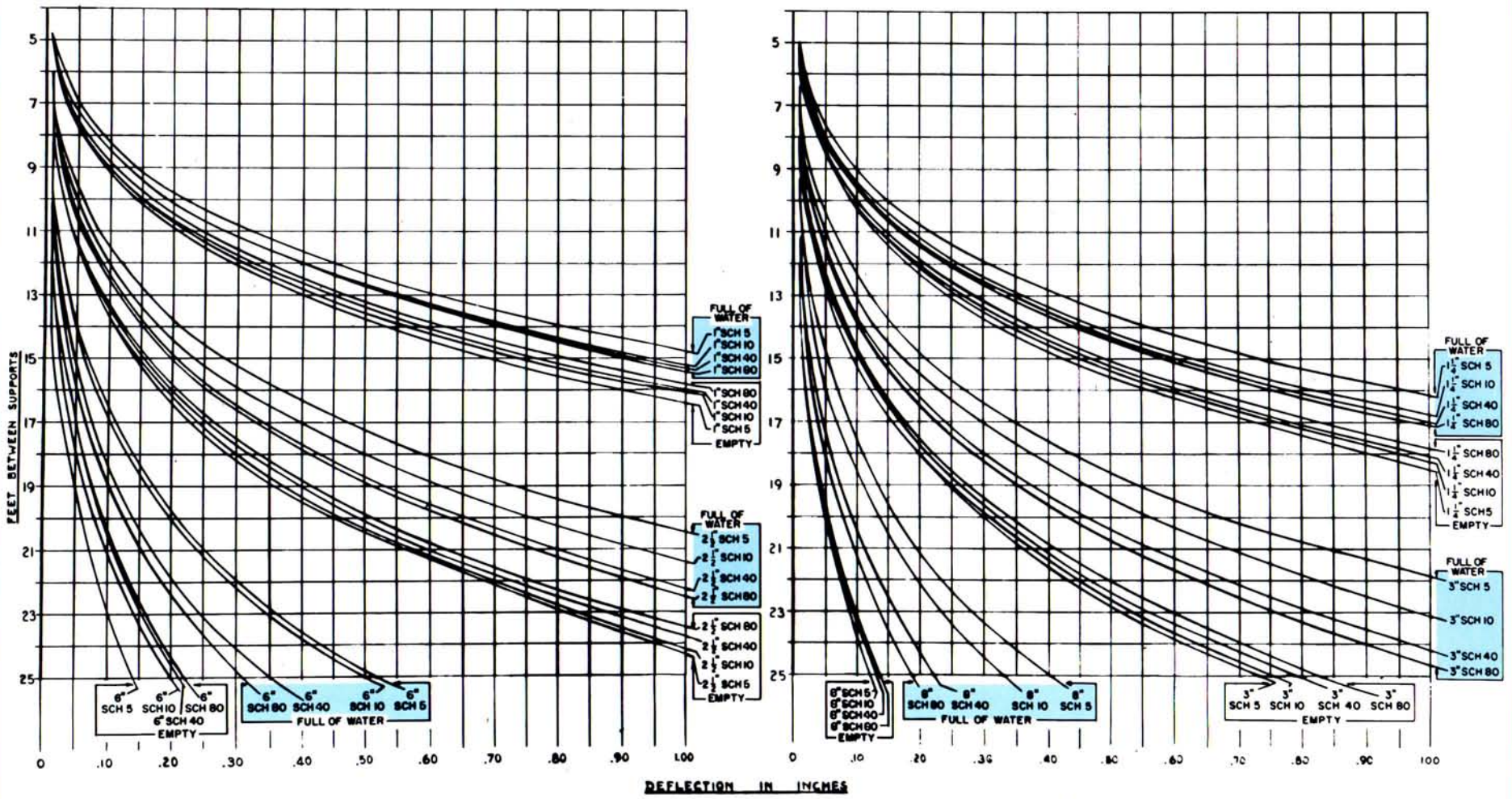
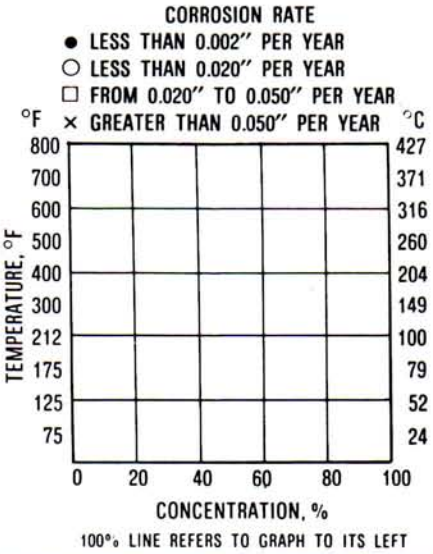


Chart C
1", 2½", 6" Pipe Sizes

Chart D
1¼", 3", 8" Pipe Sizes

For ½", ¾", 1½", 2", 3½", 4" Pipe Sizes see Charts A and B, page 85.

CORROSION EVALUATION DATA



This data summarizes previously published information in a group of charts for ready reference. Materials of construction suitable for consideration may be recognized quickly, and the inapplicable readily eliminated.

Data included in these charts, or information developed from such data, can be used only as a guide. In most cases additional corrosion testing or pilot plant experience will be required before final determinations can be made.

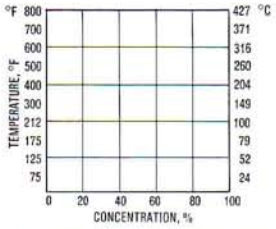
Data in this (as are data in similar) compilation do not, nor are they intended to, represent absolute values in any case. Thus the data, which indicate a material, may or may not be used with a given corrosive under a given set of conditions, and should not be construed as advice to use or not use it without further investigation or testing.

The corrosive data presented in these charts was extracted with permission from **1967 Corrosion Data Survey**, Publisher, NACE (National Association of Corrosion Engineers), 2400 W. Loop S., Houston, Texas 77027.

	TYPE 304 18-8	TYPE 316 18-8-MO	ALLOY NO. 20	MONEL	NICKEL	INCONEL	HASTELLOY	ALUMINUM	TITANIUM	ZIRCONIUM
ACETIC ACID AERATED	AVOID TRACES OF HCl, H_2SO_4 AND Na Cl		PITS				C F FeCl FREE	AVOID TRACES OF Cu,Sn,Pb	PITS	
ACETIC ACID AIR FREE	AVOID TRACES OF HCl, H_2SO_4 AND NA Cl, INTER-GRANULAR CORROSION	INTER-GRANULAR CORROSION					C F FeCl FREE	AVOID TRACES OF Cu,Sn,Pb		
ACETIC ACID VAPOR		INTER-GRANULAR CORROSION		AIR FREE	AIR FREE		C			
ACETIC ANHYDRIDE							B C D	<2% ACETIC ACID		
ACETONE							B C D			
ADIPIC ACID							C			
ALCOHOL, ETHYL							B, C, D	WATER >0.8%		
ALCOHOL, METHYL							B, C, D	WATER >1.0%		
ALUMINUM CHLORIDE	PITS	PITS	PITS	AIR FREE		PITS	B	DRY →		
ALUMINUM POTASSIUM SULFATE (ALUM)				AIR FREE			B, C	ACID FREE		
ALUMINUM SULFATE	AERATED INTER-GRANULAR CORROSION	AERATED TYPE 317 STRESS CRACKS					B, C			
AMMONIA	932 →	932 →					B, C, D			

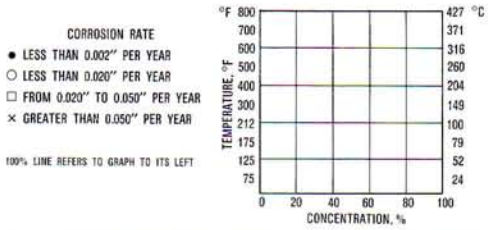
CORROSION RATE
- ● LESS THAN 0.002" PER YEAR
- ○ LESS THAN 0.020" PER YEAR
- □ FROM 0.020" TO 0.050" PER YEAR
- × GREATER THAN 0.050" PER YEAR

100% LINE REFERS TO GRAPH TO ITS LEFT



CORROSION EVALUATION DATA

	TYPE 304 18-8	TYPE 316 18-8-MO	ALLOY NO. 20	MONEL	NICKEL	INCONEL	HASTELLOY	ALUMINUM	TITANIUM	ZIRCONIUM
AMMONIUM CARBONATE							B, C, D			
AMMONIUM CHLORIDE	PITS STRESS CRACKS	PITS	PITS	DRY→	DRY→	DRY→ PITS	C	PITS		
AMMONIUM NITRATE	INTER-GRANULAR CORRISION STRESS CRACKS			EXPLOSIVE			B, C	AVOID TRACES OF Cu, Sn, Pb		
AMMONIUM PHOSPHATE							C			
AMMONIUM SULFATE	INTER-GRANULAR CORROSION				pH < 7	PITS	C, D			
AMYL ACETATE							B, C	DRY→		
ANILINE								PITS WATER >1.0%		
ANILINE SULFITE							B, C			
ARSENIC ACID					AIR FREE		B, C			
BARIUM CARBONATE							1500°F→ B, C, D			
BARIUM CHLORIDE	1900°F→ PITS STRESS CRACKS	PITS				1900°F→	B, C, D			
BARIUM HYDROXIDE							1500°F→ B, C, D			
BARIUM NITRATE		PITS					1500°F→ B			
BARIUM SULFATE							1500°F→ B			
BENZENE (BENZOL)							B, C, D			
BENZENESULFONIC ACID				AIR FREE	AIR FREE		B, C, D			

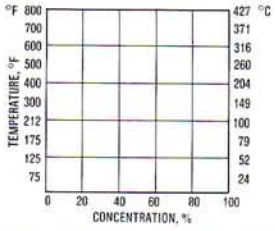


CORROSION EVALUATION DATA

	TYPE 304 18-8	TYPE 316 18-8-MO	ALLOY NO. 20	MONEL	NICKEL	INCONEL	HASTELLOY	ALUMINUM	TITANIUM	ZIRCONIUM
BENZOIC ACID							B, C, D	NaC FREE		
BORIC ACID (BORACIC ACID)	PITS	PITS		AIR FREE	AIR FREE		1500°F → B, C, D			
BROMINE (DRY)				WATER <57 ppm	WATER <57 ppm		B, C			
BROMINE (WET)							C			
BUTYL ACETATE							B, C, D			
BUTYRIC ACID				AIR FREE	AIR FREE	AIR FREE	B, C	AVOID TRACES OF Cu, Sn, Pb		
CADMIUM CHLORIDE				AIR FREE	AIR FREE		B, C			
CADMIUM SULFATE							B, C, D			
CALCIUM ACETATE							B, C, D			
CALCIUM BISULFITE (100% SOLUTION CONTAINS 10% SO_3)	INTER-GRANULAR CORROSION						C	SO_2 2%		
CALCIUM CARBONATE							1500°F → B,C,D			
CALCIUM CHLORATE	CHLORIDE FREE	CHLORIDE FREE	CHLORIDE FREE				C	CHLORIDE FREE		
CALCIUM CHLORIDE	PITS STRESS CRACKS	PITS STRESS CRACKS		AVIOD HCL+ Cu, Ni IONS	1500°F → AIR FREE	1500°F →	1500°F → AVOID Cu,Fe IONS B, C	INHIBIT		
CALCIUM HYDROXIDE							C			
CALCIUM PERMANGANATE							B, C, D			
CALCIUM SULFATE				H_2SO_4 FREE	B, C, D	PITS PASSIVATE				

CORROSION RATE
- ● LESS THAN 0.002" PER YEAR
- ○ LESS THAN 0.020" PER YEAR
- □ FROM 0.020" TO 0.050" PER YEAR
- × GREATER THAN 0.050" PER YEAR

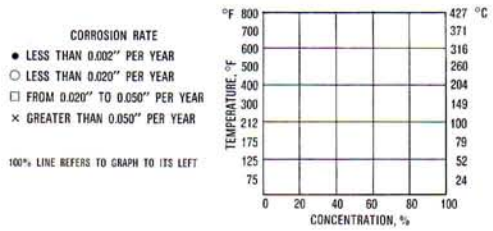
100% LINE REFERS TO GRAPH TO ITS LEFT



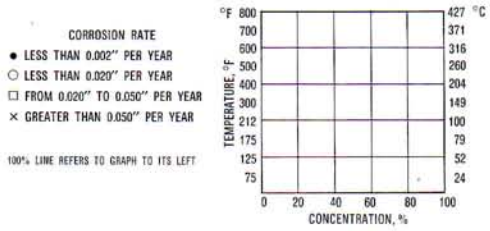
CORROSION EVALUATION DATA

	TYPE 304 18-8	TYPE 316 18-8-MO	ALLOY NO. 20	MONEL	NICKEL	INCONEL	HASTELLOY	ALUMINUM	TITANIUM	ZIRCONIUM
CAMPHOR							B, C, D			
CARBON BISULFIDE										
CARBON DIOXIDE (SEE OXIDIZING GASES)	1500°F →	1500°F →				1500°F →	B, C, D			
CARBON MONOXIDE GAS						1750°F →	B, C, D	1050°F →		
CARBON TETRACHLORIDE	STRESS CRACKS PITS DRY →						B, C, D	WATER FREE MAY EXPLODE		
CARBONIC ACID							B, C			
CELLULOSE ACETATE							B, C, D			
CELLULOSE NITRATE							B, C, D			
CHLOROACETIC ACID							C			
CHLORINE, GAS	1000°F → 900°F →	← 850°F	← 900°F	850°F →	1000°F → 900°F →	1050°F → 950°F → DRY →	C	850°F → 900°F →	AVOID DEEP CREVICES WATER INHIBITS WATER >2% →	WATER 0.6% <.005%
CHLOROFORM	STRESS CRACKS						B, C, D	DRY →		
CHLOROSULFONIC ACID	PITS	PITS					B, C	DRY →		
CHROMIC ACID	SO_2 FREE PITS INTER-GRANULAR CORROSION			STRESS CRACKS			C			
CHROMIUM SULFATE (BASIC)							B, C			
CITRIC ACID	PITS AVOID CHLORIDES	PITS		AIR FREE	AIR FREE		B, C, D	AVOID TRACES OF Cu, Sn, Pb		
COPPER CYANIDE							B, C, D			

CORROSION EVALUATION DATA

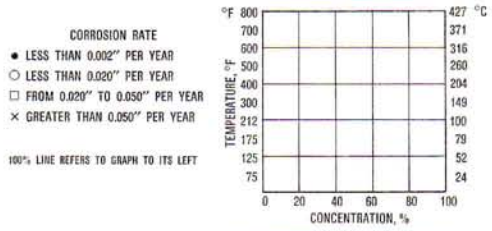


	TYPE 304 18-8	TYPE 316 18-8-MO	ALLOY NO. 20	MONEL	NICKEL	INCONEL	HASTELLOY	ALUMINUM	TITANIUM	ZIRCONIUM
COPPER NITRATE				AIR FREE	AIR FREE		C			
COPPER SULFATE	INTER-GRANULAR CORROSION	ACID FREE								
ETHYL ACETATE							B, C, D	WATER FREE		
ETHYL BENZENE							B, C			
ETHYL CHLORIDE	STRESS CRACKS				DRY	DRY	B, C, D	DRY		
ETHYLENE BROMIDE	DRY							DRY		
ETHYLENE CHLORIDE	DRY	DRY					B	DRY		
ETHYLENE DIBROMIDE	PITS DRY	PITS				PITS	B, C			
ETHYLENE GLYCOL										
ETHYLENE OXIDE							B, C, D	VERY PURE EO CATALYZES		
FATTY ACIDS	INTER-GRANULAR CORROSION				PITS		B, C, D	WATER 1.0%		
FERRIC CHLORIDE	PITS INTER-GRANULAR CORROSION	PITS	PITS				C			STRESS CRACKS
FERRIC NITRATE							C			
FERRIC SULFATE	INTER-GRANULAR CORROSION						C			
FERROUS CHLORIDE	PITS	STRESS CRACKS					B, C $FeCl_3$ FREE			
FERROUS SULFATE	PITS						B, C, D			



CORROSION EVALUATION DATA

	TYPE 304 18-8	TYPE 316 18-8-MO	ALLOY NO. 20	MONEL	NICKEL	INCONEL	HASTELLOY	ALUMINUM	TITANIUM	ZIRCONIUM
FLUORINE (GAS)	480 →			1200°F →	1200°F →	1200°F →	B, C, D	DRY →		
FLUORINE (LIQUID)									HF FREE	
FLUOSILICIC ACID	PITS	PITS	PITS	STRESS CRACKS	AIR FREE STRESS CRACKS		B, C STRESS CRACKS			
FORMALDEHYDE				DISCOLORS	DISCOLORS		B, C, D	FORMIC ACID FREE PITS		
FORMIC ACID	INTER-GRANULAR CORROSION	PITS		AIR FREE	AIR FREE		B, C	AERATED	AIR FREE	
FURFURAL							B, C, D			
GALLIC ACID							B, C, D			
GLUCONIC ACID							B, C, D			
GLUTAMIC ACID	STRESS CRACKS PITS	STRESS CRACKS PITS					B, C, D	PITS		
GLYCEROL							B, C, D			
GLYCOLIC ACID				AIR FREE	AIR FREE		B, C, D	PURE ALUMINUM NaCl FREE		
HEXAMINE							B, C, D	PITS		
HYDRAZINE		CATALYZES DUE TO Mo	CATALYZES DUE TO Mo				C	2S, 24		
HYDROBROMIC ACID	PITS	PITS			DRY →		B			
HYDROCHLORIC ACID (AERATED)							$FeCl_3$ FREE CL FREE B	STRESS CRACKS		PITS
HYDROCHLORIC ACID (AIR FREE)							$FeCl_3$ FREE CL FREE B			

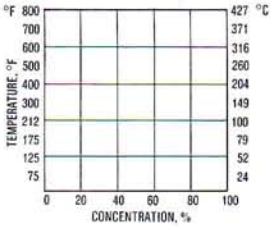


CORROSION EVALUATION DATA

	TYPE 304 18-8	TYPE 316 18-8-MO	ALLOY NO. 20	MONEL	NICKEL	INCONEL	HASTELLOY	ALUMINUM	TITANIUM	ZIRCONIUM
HYDROFLUORIC ACID (AERATED)	INTER GRANULAR CORROSION			STRESS CRACKS	STRESS CRACKS	STRESS CRACKS				
(HYDROFLUORIC ACID (AIR FREE)	INTER-GRANULAR CORROSION STRESS CRACKS			STRESS CRACKS	STRESS CRACKS	STRESS CRACKS	C			
HYDROGEN	1650°F →						B, C			
HYDROGEN CHLORIDE (ANHYDROUS HCL)	1000° → 900° → STRESS CRACKS	1000° → 900° → STRESS CRACKS			950°F →		B			
HYDROGEN CHLORIDE + STEAM							B			
HYDROGEN CYANIDE GAS										
HYDROGEN FLUORIDE	900° →			SULFUR FREE SAME ACTION WITH STEAM PRESENT	SULFUR FREE SAME ACTION WITH STEAM PRESENT		C		ACID FREE	ACID FREE
HYDROGEN IODIDE	1% ↓				-1%	AIR FREE	B, C			
HYDROGEN PEROXIDE	ACID FREE PASSIVATE	ACID FREE	ACID FREE	ALKALINE	ALKALINE	ALKALINE	B, C	PASSIVATE 25		
HYDROGEN SULFIDE (DRY)	1000° →	1000° →	1000° →			1000° →	B, C			
HYDROGEN SULFIDE (WET)	STRESS CRACKS MAY PIT						B, C	MAY CRACK		
HYDRIODIC ACID					AIR FREE		B			
HYDROXYACETIC ACID										
IODINE	842°F → PITS DRY →	842°F → PITS		DRY →	PITS DRY →		C PITS DRY →		1500°F →	
ISOPROPYL ACETATE										
LACTIC ACID	INTER-GRANULAR CORROSION PITS	INTER-GRANULAR CORROSION	AIR FREE	AIR FREE	AIR FREE		B, C, D	PITS		

CORROSION RATE
- ● LESS THAN 0.002" PER YEAR
- ○ LESS THAN 0.020" PER YEAR
- □ FROM 0.020" TO 0.050" PER YEAR
- × GREATER THAN 0.050" PER YEAR

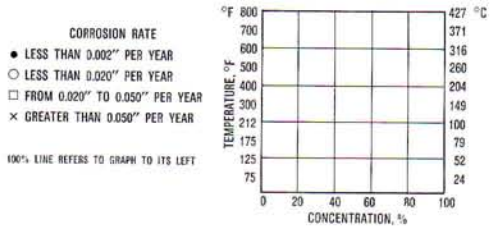
100% LINE REFERS TO GRAPH TO ITS LEFT



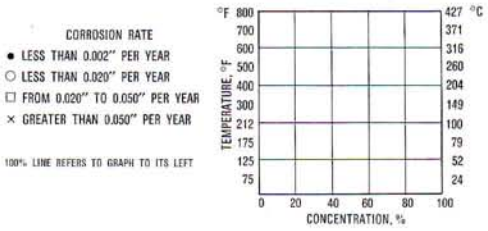
CORROSION EVALUATION DATA

	TYPE 304 18-8	TYPE 316 18-8-MO	ALLOY NO. 20	MONEL	NICKEL	INCONEL	HASTELLOY	ALUMINUM	TITANIUM	ZIRCONIUM
LACTIC ACID VAPORS	PITS	PITS					C			
LEAD ACETATE							B, C, D			
LEAD CHLORIDE							B, C, D			
LEAD NITRATE							B, C, D			
LEAD SULFATE							B, C, D			
LITHIUM CHLORIDE	1200°→ STRESS CRACKS	STRESS CRACKS		AIR FREE	1200°→ AIR FREE	PITS	B, C	PITS		
LITHIUM HYDROXIDE							B, C, D			
MAGNESIUM CHLORIDE	STRESS CRACKS PITS	STRESS CRACKS		AIR FREE	AIR FREE	AIR FREE	B, C, D	1%		AIR FREE
MAGNESIUM HYDROXIDE AND MAGNESIUM OXIDE					2000°→	2000°→	B, C, D	750°→		
MAGNESIUM SULFATE							1500°F→ B, C, D STRESS CRACKS	CHLORIDE FREE		
MALEIC ACID	INTER-GRANULAR CORROSION			AIR FREE	AIR FREE		B, C			
MALIC ACID				AIR FREE			B, C, D			
MANGANESE CHLORIDE (11.5%) +HC1										
MANGANESE SULFATE	PITS						C			
MANGANOUS CHLORIDE							C			
MERCURIC NITRATE	STRESS CRACKS			STRESS CRACKS						

CORROSION EVALUATION DATA



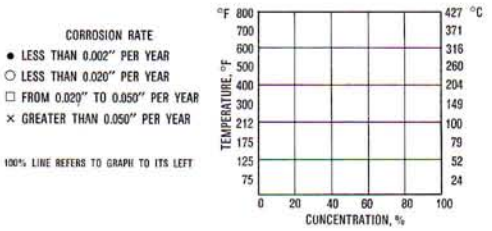
	TYPE 304 18-8	TYPE 316 18-8-MO	ALLOY NO. 20	MONEL	NICKEL	INCONEL	HASTELLOY	ALUMINUM	TITANIUM	ZIRCONIUM
MERCUROUS NITRATE	STRESS CRACKS			STRESS CRACKS			C			
MERCURY				STRESS CRACKS	932°	932°	B, C, D	STRESS CRACKS	STRESS CRACKS (HARD)	
METHALLYLAMINE										
METHANE							B, C, D			
METHYL CHLORIDE	STRESS CRACKS WHEN WET	DRY →						GNITES		
METHYLAMINE					AIR FREE		B, C, D	CHLORIDE FREE		
METHYLENE CHLORIDE	STRESS CRACKS	PITS STRESS CRACKS		ACID FREE	PITS		PITS B, C	Cu FREE NEUTRAL		
MIXED ACIDS SULFURIC-NITRIC										
MONOCHLOROACETIC ACID	PITS				PITS		B, C			
MONOCHLORODIFLUORO METHANE (FREON 22)										
MONOETHANOLAMINE										
MONO- SODIUM PHOSPHATE AMMONIUM PHOSPHATE POTASSIUM PHOSPHATE				AIR FREE	AIR FREE		B, C, D			
NAPHTHALENE										
NAPHTHENIC ACID	IGC STRESS CRACKS			SULFUR FREE AIR FREE	SULFUR FREE AIR FREE		C	WATER 0.1%		
NICKEL CHLORIDE	PITS STRESS CRACKS			AIR FREE			B			
NICKEL NITRATE				DRY →	DRY →	900°F → DRY →	B, C			



CORROSION EVALUATION DATA

	TYPE 304 18-8	TYPE 316 18-8-MO	ALLOY NO. 20	MONEL	NICKEL	INCONEL	HASTELLOY	ALUMINUM	TITANIUM	ZIRCONIUM
NICKEL SULFATE				AIR FREE	PITS AIR FREE	AIR FREE	C			
NITRIC ACID	TYPE 347 TYPE 321	INTER-GRANULAR CORROSION					F	0.5%		
NITRIC ACID (RED FUMING)							C		STRESS CRACKS WATER 1.5%	
NITRIC ACID (WHITE FUMING)									STRESS CRACKS	
NITRIC ACID + HYDROCHLORIC ACID (AQUA REGIA)	INTER-GRANULAR CORROSION						C			
NITRIDING GASES							B, C, D			
NITROBENZENE					ACID FREE					
NITROGLYCERINE							B, C, D			
NITROUS ACID										
OLEIC ACID	PITS						B, C, D	WATER >1.0%		
OXALIC ACID	INTER-GRANULAR CORROSION	INTER-GRANULAR CORROSION		AIR FREE			B, C, D			
PERCHLORIC ACID	DRY→	DRY→								
PERCHLOROETHYLENE	PITS	PITS					B, C			
PHENOL	PITS				SULFUR FREE		B, C, D	240°F WATER >0.3%		
PHENOLSULFONIC ACID							B			
PHOSPHORIC ACID (AERATED)	INTER-GRANULAR CORROSION	INTER-GRANULAR CORROSION					B			

CORROSION EVALUATION DATA



	TYPE 304 18-8	TYPE 316 18-8-MO	ALLOY NO. 20	MONEL	NICKEL	INCONEL	HASTELLOY	ALUMINUM	TITANIUM	ZIRCONIUM
PHOSPHORIC ACID (AIR-FREE)	INTER GRANULAR CORROSION						B			
PHOSPHORUS							B, C, D	DRY→		
PHTHALIC ACID	INTER GRANULAR CORROSION						B, C			
PHTHALIC ANHYDRIDE			PITS				B, C	PITS		
PHTHALIC ANHYDRIDE (PURE) +MALEIC ANHYDRIDE							B			
PICRIC ACID							C			
POTASSIUM ACETATE							B, C, D			
POTASSIUM BICARBONATE							B, C, D			
POTASSIUM BROMIDE	PITS	PITS		AIR FREE	AIR FREE		B, C, D	PITS		
POTASSIUM CARBONATE							1500°F B, C, D			
POTASSIUM CHLORATE							C, D	CHLORIDE FREE		
POTASSIUM CHLORIDE	PITS STRESS CRACKS	pH > 7 PITS	PITS		1500°F→	PITS	B, C	PITS		
POTASSIUM CHROMATES							B, C, D			
POTASSIUM CYANIDE				AIR FREE	AIR FREE		B, C, D			
POTASSIUM DICHROMATE							1500°F→ C			
POTASSIUM FERRICYANIDE	PITS						B, C, D	NEUTRAL		

CORROSION RATE

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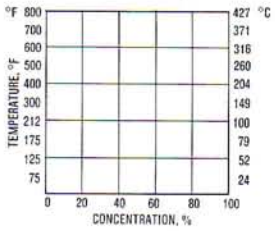
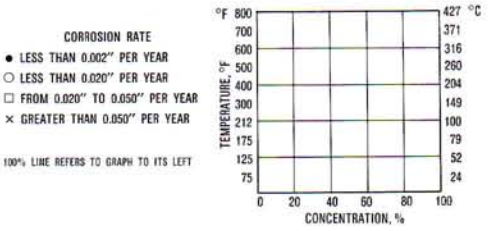
- ○ LESS THAN 0.020" PER YEAR
- □ FROM 0.020" TO 0.050" PER YEAR
- × GREATER THAN 0.050" PER YEAR

100% LINE REFERS TO GRAPH TO ITS LEFT



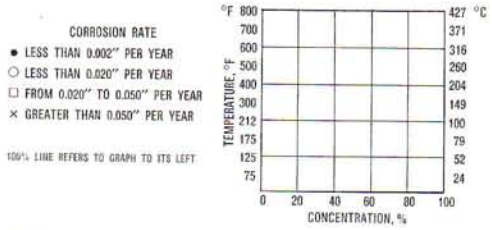
CORROSION EVALUATION DATA

	TYPE 304 18-8	TYPE 316 18-8-MO	ALLOY NO. 20	MONEL	NICKEL	INCONEL	HASTELLOY	ALUMINUM	TITANIUM	ZIRCONIUM
POTASSIUM FERROCYANIDE	PITS						B, C, D	NEUTRAL		
POTASSIUM FLUORIDE										
POTASSIUM HYDROXIDE	STRESS CRACKS	STRESS CRACKS		AIR FREE STRESS CRACKS	AIR FREE	AIR FREE	B			
POTASSIUM HYPOCHLORITE	PITS	PITS		PITS	PITS	PITS	C D			
POTASSIUM IODIDE	PITS						B, C, D			
POTASSIUM NITRATE	1500°F→			AIR FREE	AIR FREE		C			
POTASSIUM NITRITE										
POTASSIUM OXALATE										
POTASSIUM PERMANGANATE							C			
POTASSIUM PEROXIDE					STRESS RELIEVE		B, C, D			
POTASSIUM SILICATE							B, C, D			
POTASSIUM SULFATE							B, C			
PROPIONIC ACID (ALSO SEE ACETIC ACID)				AIR FREE	AIR FREE		C			
PYRIDINE						PITS	B			
PYROGALLIC ACID							B, C, D			
PYROLIGNEOUS ACID				AIR FREE			B			



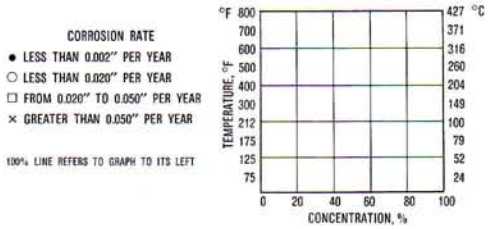
CORROSION EVALUATION DATA

	TYPE 304 18-8	TYPE 316 18-8-MO	ALLOY NO. 20	MONEL	NICKEL	INCONEL	HASTELLOY	ALUMINUM	TITANIUM	ZIRCONIUM
QUININE SULFATE	NATURAL						B, C, D			
ROSIN										
SALICYLIC ACID							B, C, D			
SELENIOUS ACID										
SILVER NITRATE	ACID FREE	ACID FREE					B, C, D			
SODIUM ACETATE	PITS						B, C, D			
SODIUM ALUMINUM SULFATE							B, C, D			
SODIUM BICARBONATE							B, C, D			
SODIUM BICHROMATE							C			
SODIUM BISULFATE	INTER-GRANULAR CORROSION, PITS, PITS			AIR FREE	AIR FREE		430° B, D, Cu FREE			
SODIUM BISULFIDE							B			
SODIUM BISULFITE	STRESS CRACKS	STRESS CRACKS		FITS IN VAPORS			C			
SODIUM BROMIDE	1300°F→x MAY PIT, 1700°F→x	1700°F→x	1700°F→x			1700°F→	B, C, D PITS, 1500°F→			
SODIUM CARBONATE							B, C, D			
SODIUM CHLORATE	Cl FREE	Cl FREE	Cl FREE	H_2SO_4 FREE	H_2SO_4 FREE	H_2SO_4 FREE	C	H_2SO_4 FREE		
SODIUM CHLORIDE	1300°F→x PITS pH>7	STRESS CRACKS	PITS AIR FREE	1300°F→x	1300°F→x	1300°F→x	B, C, D		STRESS CRACKS→	



CORROSION EVALUATION DATA

	TYPE 304 18-8	TYPE 316 18-8-MO	ALLOY NO. 20	MONEL	NICKEL	INCONEL	HASTELLOY	ALUMINUM	TITANIUM	ZIRCONIUM
SODIUM CHLORIDE SLURRY	PITS					PITS				
SODIUM CHROMATE							B, C, D			
SODIUM CITRATE							B, C, D			
SODIUM CYANIDE	1300°F → PITS	1300°F → PITS		1300°F → ×	1300°F → ×	1300°F →	×	×××	×	
SODIUM FERRICYANIDE	PITS						B, C, D			
SODIUM FLUORIDE	1300° → × STRESS CRACKS PITS						B, C, D	× ×		
SODIUM HYDROSULFIDE							C			
SODIUM HYDROXIDE	15% STRESS CRACKS	STRESS CRACKS	STRESS CRACKS	75% STRESS CRACKS	STRESS CRACKS	STRESS CRACKS	B STRESS CRACKS	×××		
SODIUM METASILICATE				COPPER FREE		AVOID TRACES OF Cu	B, C, D			
SODIUM NITRATE	950°F → MAY PIT	950°F →			950°F →	950°F →	C			
SODIUM NITRITE							B, C, D	PITS		
SODIUM PERBORATE							B, C, D			
SODIUM PEROXIDE							B, C, D	Co_2 FREE		
SODIUM PHOSPHATE							B, C, D			
SODIUM PHOSPHATE (TRIBASIC)							B, C, D			
SODIUM SILICATE							B, C, D			

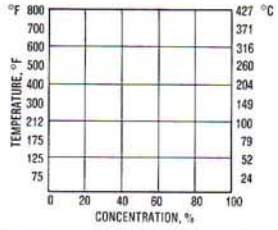


CORROSION EVALUATION DATA

	TYPE 304 18-8	TYPE 316 18-8-MO	ALLOY NO. 20	MONEL	NICKEL	INCONEL	HASTELLOY	ALUMINUM	TITANIUM	ZIRCONIUM
SODIUM SULFATE	1550°F→ STRESS CRACKS	1550°F→			1950°F→		B, C, D			
SODIUM SULFIDE	PITS					STRESS CRACKS	B, C, D			
SODIUM SULFITE							C			
STANNIC CHLORIDE	<1.0%	<1.0%					B			
STANNOUS CHLORIDE	PITS			DRY→	DRY→	DRY→	PITS B			
STEAM	1450°F→			STRESS CRACKS	800°F→	1500°F→ STRESS CRACKS				
STEARIC ACID							B, C, D			
STRONTIUM NITRATE							C			
SUCCINIC ACID							B, C, D			
SULFATE BLACK LIQUOR							B, C			
SULFATE GREEN LIQUOR	STRESS CRACKS						B, C			
SULFATE LIQUOR	INTER-GRANULAR CORROSION STRESS CRACKS									
SULFITE LIQUOR 100% SOLUTION CONTAINS 10% SO_2)							C			
SULFUR	835°→ MAY PIT	850°→		AIR FREE	STRESS CRACKS AIR FREE	AIR FREE	850°→ C			
SULFUR CHLORIDE	DRY→	DRY→	DRY→				C			
SULFUR DIOXIDE	1200°F→ INTER-GRANULAR CORROSION		AVOID TRACES OF NaCl	DRY→	EMBRITTLES DRY→	1500°F→ DRY→	C			

CORROSION RATE
- ● LESS THAN 0.002" PER YEAR
- ○ LESS THAN 0.020" PER YEAR
- □ FROM 0.020" TO 0.050" PER YEAR
- × GREATER THAN 0.050" PER YEAR

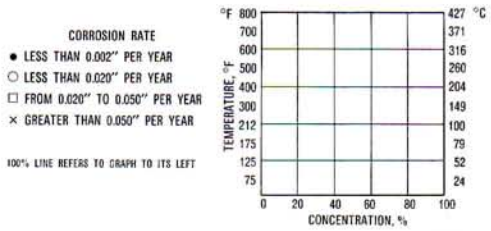
100% LINE REFERS TO GRAPH TO ITS LEFT



CORROSION EVALUATION DATA

	TYPE 304 18-8	TYPE 316 18-8-MO	ALLOY NO. 20	MONEL	NICKEL	INCONEL	HASTELLOY	ALUMINUM	TITANIUM	ZIRCONIUM
SULFUR TRIOXIDE	1200°F→ DRY						C, D			
SULFURIC ACID (AERATED) NO VELOCITY	INTER-GRANULAR CORROSION	INTER-GRANULAR CORROSION					B, D			
SULFURIC ACID (AIR FREE) NO VELOCITY	INTER-GRANULAR CORROSION	INTER-GRANULAR CORROSION					B, D			
SULFURIC ACID (FUMING) OLEUM							C			
SULFUROUS ACID	INTER-GRANULAR CORROSION	INTER-GRANULAR CORROSION					B, C, D			
TALL OIL							B, C			
TANNIC ACID							B, C			
TARTARIC ACID	AVOID CHLORIDES			AIR FREE	AIR FREE		B, C, D			
TETRAPHOSPHORIC ACID							B, C			
TITANIUM TETRACHLORIDE	DRY→						C			
TOLUENE							B, C, D			
TRICHLOROACETIC ACID							B, C, D			
TRICHLOROETHYLENE	MAY PIT WHEN WET	PITS		PITS	PITS	PITS	B, C			
TRICHLOROMONOFLUORO-ETHANE (FREON 17)							B, C			
TRICHLOROPROPANE							B, C			
TRICHLOROTRIFLUORO ETHANE (FREON 113)							B, C			

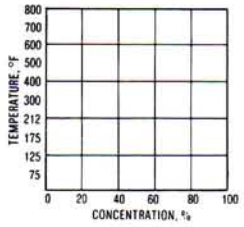
CORROSION EVALUATION DATA



	TYPE 304 18-8	TYPE 316 18-8-MO	ALLOY NO. 20	MONEL	NICKEL	INCONEL	HASTELLOY	ALUMINUM	TITANIUM	ZIRCONIUM
TRIPHENYL PHOSPHITE										
TRIPOTASSIUM PHOSPHATE								xxx		
TRISODIUM PHOSPHATE							B, C, D	xx		
UREA				NH_3 FREE	NH_3 FREE	NH_3 FREE	NH_3 FREE B			
URIC ACID							B, C, D		x	
VANADIUM ASHES (FROM V CONTAINING FUEL OIL)	1200°F→x	1200°F→x	1200°F→x							
VANADIUM PENTOXIDE	1200°F→x	1200°F→x	1200°F→x							
VINYL CHLORIDE	STRESS CRACKS pH > 3						B, C	INHIBIT		
ZINC CARBONATE							C			
ZINC CHLORIDE	PITS STRESS CRACKS	STRESS CRACKS		AIR FREE DRY→	AIR FREE DRY→	DRY→	B			
ZINC SULFATE				AIR FREE	AIR FREE		B, C, D			

CORROSION RATE
- ● LESS THAN 0.002" PER YEAR
- ○ FROM 0.002" TO 0.004" PER YEAR
- □ FROM 0.004" TO 0.008" PER YEAR
- × GREATER THAN 0.008" PER YEAR

100%+ LINE REFERS TO GRAPH TO ITS LEFT



PITTING TENDENCIES:
- ● UP TO .005" DEEP
- ○ UP TO .020" DEEP
- □ UP TO .050" DEEP
- × GREATER THAN .050" DEEP

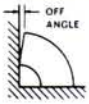
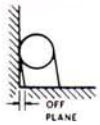
EXAMPLE: 18 Cr–8 Ni STAINLESS STEEL IN SEA WATER AT ROOM TEMPERATURE FLOWING LESS THAN 5 FT. PER SEC. CORRODES AT THE RATE OF LESS THAN .002" PER YEAR BUT WILL ALSO HAVE PITTING TENDENCIES WHICH WILL BE GREATER THAN .050" DEEP.

CORROSION EVALUATION DATA

	TYPE 304 18-8	TYPE 316 18-8-MO	ALLOY NO. 20	MONEL	NICKEL	INCONEL	HASTELLOY	ALUMINUM	TITANIUM	ZIRCONIUM
ATMOSPHERE (INDUSTRIAL)	PITS	PITS								
ATMOSPHERE (RURAL)										
BOILER FEED WATER	STRESS CRACKS			Co_2 FREE						
BRACKISH WATER	STRESS CRACKS PITS ○				PITS ○					
DISTILLED WATER (AIR FREE)								STRESS CRACKS		
DISTILLED WATER (AERATED)										
RETURN CONDENSATE 0_2 – 4.6PPM CO_2 – 14.PPM										
SEA WATER (VELOCITY< 5 FT./SEC)	PITS ×	STRESS CRACKS PITS ×		PITS ●	PITS □	PITS □	B, C PITS ⊟ ⊟●	2S, 24ST, 53S, 525 PITS AVOID Cu, Ni IONS		
SEA WATER (VELOCITY>5 FT./SEC.)	PITS ●	PITS ●								
WATER pH < 7										
WATER pH > 7										
WATER SATURATED WITH 30% CO_2, 70% AIR										
WATER SATURATED WITH 70% CO_2, 30% AIR										
DEIONIZED WATER										
SALT BRINE (10%) (AERATED)										

DIMENSIONAL TOLERANCES

Established tolerances for Speedline Fittings conform to Manufacturers Standardization Society and U.S.A. Standards and are in accordance with M.S.S. SP-43 and ANSI Specification B16.9, where applicable. Limits shown below are the maximum allowable variations permitted by the specifications. SPEEDLINE manufacturing techniques and inspection procedures usually insure that finished fittings will be closer to stated dimensional size than required by the specifications. Dimensions shown are in inches.

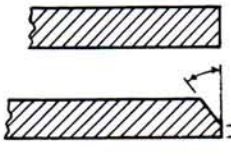
	PIPE SIZE (inches)									
	1/2	3/4	1	1 1/4	1 1/2	2	2 1/2	3	4	6
OUTSIDE DIAMETER at Welding End **Schedules 5 & 10** Maximum allowable variation from published Speedline fittings dimensions	+1/64 −1/32					±1/32				+1/16 −1/32
OUTSIDE DIAMETER at Welding End **Schedule 40** Maximum allowable variation from published Speedline fittings dimensions	+1/16 −1/32							±1/16		+3/32 −1/16
WALL THICKNESS* **All Schedules** Maximum variation from nominal thickness for schedule and size.	87-1/2% of Nominal									
CENTER TO END 90° & 45° Elbows—Tees **All Schedules** Maximum allowable variation from published Speedline fittings dimensions	±1/16									
CENTER-TO-CENTER 180° Return Bends **All Schedules** Maximum allowable variation from published Speedline fittings dimensions	±1/4									
LENGTH Type C Stub Ends Concentric & Eccentric Reducers **All Schedules** Maximum allowable variation from published Speedline dimensions	±1/16									
O.D. Type C Stub End Lap **Schedules 5, 10 and 40** Maximum allowable variation from published Speedline dimensions	+0 −1/32									
LAP THICKNESS Type C Stub End **Schedules 5, 10 and 40** Maximum allowable variation from nominal thickness for schedule and size.	87-1/2% of Nominal									
CAPS—OVERALL LENGTH **All Schedules** Maximum allowable variation from published Speedline dimensions	±1/8									±1/4
ANGLE ANGULARITY **All Schedules** Maximum allowable off-angle tolerance 	1/32									1/16
PLANE ANGULARITY **All Schedules** Maximum allowable off-plane tolerance 	1/16									1/8

For Tee and Lateral Tolerances, see footnote on fittings data pages.

END DETAIL

To maintain versatility all fittings except caps and stub ends are normally supplied with ends cut square.

Any Speedline fitting may be ordered with ends beveled. 6" Sch. 5 and all Sch. 10 Caps and Stub Ends are normally beveled.



Speedline® EXPANDED JOINT . . . ENGINEERING DATA

DESIGN EXPERIENCE TESTS

The American Standard Code for Pressure Piping USAS B31.3 Paragraph 313 states:

> *Expanded joints may be used where experience or test have demonstrated that the joint is suitable for the conditions and where adequate provisions are made in the design to prevent separation of the joints.*

Speedline EXPERIENCE

The first Insert Flanges for corrosion resistant process piping were developed by Speedline more than 20 years ago. During that time, well over a half million Insert Flanges have been produced for use in many types of applications. Performance has proven them equal to the varying and demanding conditions experienced in present day processing plants.

Speedline DESIGN

The original Insert Flange design was substantially improved in 1963 with introduction of Taper Design. Rotatability for ease of bolt hole alignment and the already proven advantages of expanding type flanges were brought together in the T/D Insert Flange. The resulting flange design quickly gained wide acceptance in the many segments of the processing industries.

Speedline TESTS

A variety of tests during the developmental period and others programmed on a continuing basis insure maintenance of the highest performance standards. Some of the tests cited below were conducted in our own plant, others were performed by outside independent laboratories of nationally recognized capability. All tests listed and others in our files attest to the complete reliability of the Speedline expanded joint.

HYDROSTATIC TESTS

TEST ASSEMBLY	TEST ● Media ● Temperature ○ Time	TEST PROCEDURE	NATURE OF FAILURE	POINT OF FAILURE	PIPING CODE Allowable non-shock working pressure for pipe
2" IPS Sch. 5 Type 304L welded pipe with Speedline T/D Insert Flanges expanded both ends.	● Water ● Ambient ○ To failure	Hydrostatic pressure applied to failure.	Pipe burst	3700 psig	612 psig
2" IPS Sch. 10 Type 304L welded pipe with Speedline T/D Insert Flanges expanded both ends.	● Water ● Ambient ○ To failure	Hydrostatic pressure applied to failure.	Pipe burst	5250 psig	1033 psig
4" IPS Sch. 5 Type 316L welded pipe with Speedline T/D Insert Flanges expanded both ends.	● Water ● Ambient ○ To failure	Hydrostatic pressure applied to failure.	Pipe burst	2250 psig	411 psig
2" IPS Sch. 10 Aluminum 3003 pipe with Speedline Aluminum Flanges expanded both ends.	● Water ● Ambient ○ To failure	Hydrostatic pressure applied to failure.	Pipe burst	1450 psig	298 psig
4" IPS Sch. 40 Aluminum 3003 pipe with Speedline Aluminum Flanges expanded both ends.	● Water ● Ambient ○ To failure	Hydrostatic pressure applied to failure.	Gasket	1450 psig	344 psig

SHOCK TEST

4" IPS Sch. 10 Type 304L Speedline Tee with T/D Insert Flanges expanded all ends.	● Water ● Ambient ○ To failure	To a low static pressure — sudden surge pressures of increasing magnitude applied to failure.	Gasket	2150 psig	594 psig

Test information provided in this catalog is advisory only and may be used to the degree permissible under appropriate piping codes governing engineering of process lines.

TENSILE TESTS

TEST ASSEMBLY	TEST ● Media ● Temperature ○ Time	TEST PROCEDURE	NATURE OF FAILURE	POINT OF FAILURE	PIPING CODE Allowable non-shock working pressure for pipe
1" IPS Sch. 40 Type 304L welded pipe with T/D Insert Flanges expanded both ends.	● None ● Ambient ○ To failure	Tensile load to failure applied perpendicular to flanges.	Pipe pulled out of insert.	8950# (10,359 psig equivalent internal hydrostatic)	2373 psig
2" IPS Sch. 10 Type 304L welded pipe with T/D Insert Flanges expanded both ends.	● None ● Ambient ○ To failure	Tensile load to failure applied perpendicular to flanges.	Insert pulled out of flange.	39,950# (10,933 psig equivalent internal hydrostatic)	1033 psig
2" IPS Sch. 40 Type 304L welded pipe with T/D Insert Flanges expanded both ends.	● None ● Ambient ○ To failure	Tensile load to failure applied perpendicular to flanges.	Pipe pulled out of insert.	35,300# (10,518 psig equivalent internal hydrostatic)	1489 psig
4" IPS Sch. 5 Type 304L welded pipe with T/D Insert Flanges expanded both ends.	● None ● Ambient ○ To failure	Tensile load to failure applied perpendicular to flanges.	Test fixture failed.	35,600# (2,414 psig equivalent internal hydrostatic)	411 psig

ELEVATED TEMPERATURE TESTS

TEST ASSEMBLY	TEST ● Media ● Temperature ○ Time	TEST PROCEDURE	NATURE OF FAILURE	POINT OF FAILURE	PIPING CODE Allowable non-shock working pressure for pipe
2" IPS Sch. 5 Type 304L welded pipe with T/D Insert Flange expanded one end, other end closed off with plate.	● SAE #10 Oil ● Ambient to 650°F ○ 216 Hours	Cycled from ambient to 650°F. Pressure from 0 to 1200 psig.	None	None	343 psig
2" IPS Sch. 5 Type 304L welded pipe with T/D Insert Flange expanded one end.	● SAE #10 Oil ● 675°F ○ To failure	Pressurized to failure.	Gasket	1800 psig	338 psig
2" IPS Sch. 10 Type 304L welded pipe with 300# T/D Insert Flange expanded one end.	● SAE #10 Oil ● 450°F to 520°F ○ 144 Hours	Temperature range 450°F to 520°F. Pressure range 450 psig to 1460 psig.	None	None	631 psig
2" IPS Sch. 10 Type 304L welded pipe with 300# T/D Insert Flange expanded one end.	● SAE #10 Oil ● Ambient to 520°F ○ 28 Hours	Severely cycled from ambient to 520°F. Pressure varied from 0 to 1460 psig.	None	None	631 psig
2" IPS Sch. 10 Type 304L welded pipe with 300# T/D Insert Flange expanded one end.	● SAE #10 Oil ● 580°F ○ To failure	Pressurized to failure.	Gasket	4050 psig	604 psig
3" IPS Sch. 10 Type 304L welded pipe with T/D Insert Flanges expanded both ends.	● Water & Steam ● Ambient to 350/380°F ○ 64 Hours	Cycled every 2 hours from ambient water to 400 psig steam. Test continued at ambient temp. to failure.	None Gasket	None 2922 psig	593 psig 768 psig
4" IPS Sch. 5 Type 304L welded pipe with T/D Insert Flange expanded one end.	● SAE #10 Oil ● Ambient to 650°F ○ 216 Hours	Cycled from ambient to 650°F. Pressures from 0 to 600 psig.	None	None	230 psig
4" IPS Sch. 5 Type 304L welded pipe with T/D Insert Flange expanded one end.	● SAE #10 Oil ● 650°F ○ To failure	Pressurized to failure.	Gasket	750 psig	230 psig

Speedline® FITTING WEIGHTS

STAINLESS STEEL — SCHEDULE 5S

Pipe Size	90° Elbow	45° Elbow	180° Bend	Cap	Straight Tee	Cross	Lateral	True Y	Type C Stub End
½	.13	.12	.25	.02	.25	.33	.51	.28	.07
¾	.28	.19	.53	.02	.38	.49	.70	.39	.13
1	.36	.23	.75	.06	.50	.65	1.00	.51	.16
1¼	.53	.25	1.06	.08	.75	.95	1.40	.73	.19
1½	.62	.38	1.25	.14	.88	1.13	1.76	.87	.25
2	1.06	.70	2.00	.18	1.30	1.68	2.61	1.44	.38
2½	1.63	1.10	3.20	.28	2.38	3.05	4.65	2.30	.70
3	2.88	1.88	4.30	.50	3.25	3.99	6.30	3.62	.88
4	4.80	3.06	8.50	.76	4.75	5.75	9.12	5.80	1.38
6	12.00	7.50	20.80	1.57	11.50	14.15	21.16	14.65	2.75

STAINLESS STEEL — SCHEDULE 10S

Pipe Size	90° Elbow	45° Elbow	180° Bend	Cap	Straight Tee	Cross	Lateral	True Y	Type C Stub End
½	.25	.13	.40	.03	.35	.45	.81	.35	.11
¾	.31	.20	.63	.06	.45	.59	.88	.45	.15
1	.50	.38	1.20	.10	.90	1.15	1.61	.75	.23
1¼	.75	.50	1.80	.13	1.30	1.63	2.29	1.08	.33
1½	1.00	.67	2.00	.23	1.50	1.92	2.90	1.42	.48
2	1.75	1.20	3.20	.30	2.13	2.76	4.30	2.38	.80
2½	2.50	1.63	4.80	.40	3.63	4.59	6.64	3.46	.96
3	4.00	2.63	6.40	.72	4.50	5.56	9.01	5.06	1.20
4	7.00	4.88	13.50	1.16	6.38	7.81	13.08	8.43	2.00
6	14.00	9.00	26.50	3.25	14.00	17.24	25.92	17.24	3.25

REDUCERS

Pipe Size		Sch. 5S	Sch. 10S
¾	x ½	.18	.30
1	x ½	.25	.62
	x ¾	.30	.63
1¼	x ¾	.33	.72
	x 1	.35	.74
1½	x ¾	.37	.88
	x 1	.40	.91
	x 1¼	.43	.94
2	x 1	.46	1.13
	x 1¼	.50	1.17
	x 1½	.60	1.20
2½	x 1	1.00	1.30
	x 1¼	1.10	1.44
	x 1½	1.13	1.50
	x 2	1.20	1.43
3	x 1¼	1.25	1.70
	x 1½	1.30	1.75
	x 2	1.33	1.80
	x 2½	1.40	1.90
4	x 2	1.50	2.25
	x 2½	1.60	2.31
	x 3	1.63	2.35
6	x 2½	5.50	6.75
	x 3	5.65	6.93
	x 4	5.69	6.97

FLANGES — ALIGNING CONNECTORS

Speedline	½	¾	1	1¼	1½	2	2½	3	4	6	8	10
T/D Flange Stainless Steel Insert	1.00	1.38	1.75	2.38	2.75	4.50	7.00	8.25	11.63	15.25	51.00	78.00
Aluminum Flange	.44	.50	.63	.75	1.13	1.75	2.50	2.88	4.25	—	—	—
Back-Up Flange Forged Steel	1.00	1.25	1.50	2.50	3.31	4.87	7.43	8.75	12.25	14.50	—	—
Aligning Connector Stainless Steel	.06	.10	.13	.15	.18	.20	.43	.53	.75	1.50	—	—

UNIONS — STAINLESS STEEL FERRULES — CARBON STEEL NUTS

Speedline	½	¾	1	1¼	1½	2	2½	3	4
Expanding Type PE	.45	.88	1.00	1.50	2.38	—	—	—	—
Welding Type PW	.50	.96	1.13	1.69	1.56	1.70	2.65	3.00	3.50
Butt Weld Type PBW	.59	1.07	1.30	1.91	1.83	2.06	3.06	3.53	4.15

CONVERSION FACTORS OTHER METALS

Nickel & Nickel Alloys	1.125
Aluminum	.345
Hastelloy B	1.168
Hastelloy C	1.130
Titanium	.571

APPROXIMATE WEIGHT IN POUNDS. DIMENSIONS ARE IN INCHES.

CHEMICAL COMPOSITION OF CORROSION RESISTANT PIPE

Grade	A.S.T.M.	Carbon %	Manganese Max. %	Phosphorus Max. %	Sulphur Max. %	Silicon Max. %	Nickel %	Chromium %	Molybdenum %	Other	Iron %
Type 304	A-312	0.08 max.	2.00	0.040	0.030	0.75	8.00-11.0	18.0-20.0	.....	.....	Balance
Type 304L	A-312	0.035 max.	2.00	0.040	0.030	0.75	8.00-13.0	18.0-20.0	.....	.....	Balance
Type 316	A-312	0.08 max.	2.00	0.040	0.030	0.75	11.0-14.0	16.0-18.0	2.0-3.0	.....	Balance
Type 316L	A-312	0.035 max.	2.00	0.040	0.030	0.75	10.0-15.0	16.0-18.0	2.0-3.0	.....	Balance
Alloy 20Cb-3	B-464	0.07 max.	2.00	0.045	0.035	1.00	32.0-38.0	19.0-21.0	2.00-3.00	Cb plus Ta: Min.—8 x C Max.—1.0% Cu: 3.0-4.0%	Balance
Nickel 200	B-161	0.15 max.	0.35	....	0.01	0.35	99.0 min.	.....	.....	Copper Max.:—0.25%	0.40 max.
Monel 400	B-165	0.30 max.	2.00	....	0.024	0.50	63.0-70.0	.....	.....	Copper: Remainder	2.50 max.
Inconel Alloy 600	B-167	0.15 max.	1.0	....	0.015	0.5	72.0 min.	14.0-17.0	.....	Copper Max.:—0.50%	6.0-10.0
Hastelloy Alloy B	(a)	0.05 max.	1.0	.025	.03	1.0	Balance	1.0	26.0-30.0	Co max.: 2.50% V: 0.20-0.40%	4.0-6.0
Hastelloy Alloy C	(b)	0.08 max.	1.0	.04	.03	1.0	Balance	14.5-16.5	15.0-17.0	Co max.: 2.50% W: 3.0-4.5% V: 0.35%	4.0-7.0
Hastelloy Alloy C-276	(c)	LAP	1.0	....	....	LAP	Balance	14.5-16.5	15.0-17.0	Co max.: 2.50% W: 3.0-4.5% V: 0.35% max.	4.0-7.0

LAP—Low As Possible

(a) ASME Code Case 1323 (Special Ruling)
(b) ASME Code Case 1324 (Special Ruling)
(c) ASME Code Case 1410 (Special Ruling)

Speedline® FITTINGS ARE PRODUCTS OF

SPEEDLINE, INC.

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