

# Operation & Maintenance Manual



# Grooved Fittings

## Description:

The SHIELD Grooved System provides an economical and efficient piping system solution and offers significant benefits when compared to conventional types of pipe connections including:

- Faster Installation
- Because there is no need for welding or heating, the SHIELD System ensures a safer and reliable working environment
- Ensures easy alignment
- Reduces noise and vibration
- Easy to install and remove in case of any maintenance requirements

## SHIELD Grooved Systems

Wide range of coupling and fittings for piping applications in Air Conditioning, Fire Fighting Systems and water pipelines etc.

## SHIELD Grooved Systems offer 3 types of couplings:

- High Pressure Couplings (Flexible)
- Medium Pressure Couplings (Rigid, Flexible)
- Light Pressure Couplings (Rigid, Flexible)

## Material

SHIELD Grooved Coupling housing and other grooved fittings are cast from Ductile Iron to ASTM A536 Grade 65-45-12 in red paint or hot dipped galvanized, bolts are carbon steel to ISO 898-1 class 8.8 heat treated.



## Gasket (C shaped)

It is important to use the gasket that suits your application, use the table below to select the optimum gasket.

Material	Temperature Range	Colour	General Recommended Application
EPDM	-34°C to +110°C	Green Strip	Hot water service, variety of diluted acid, oil free air, chemical. <i>This is NOT recommended for Petroleum services.</i>
Nitrile	-29°C to +82°C	Orange Strip	Petroleum products, vegetable and mineral oils, air with oil vapours.
Silicone	-34°C to +177°C	Red Gasket	<i>This is NOT recommended for hot water.</i> +66°C or for hot dry air over +60°C. Dry heat and air without hydrocarbons up to +177°C and certain chemicals.

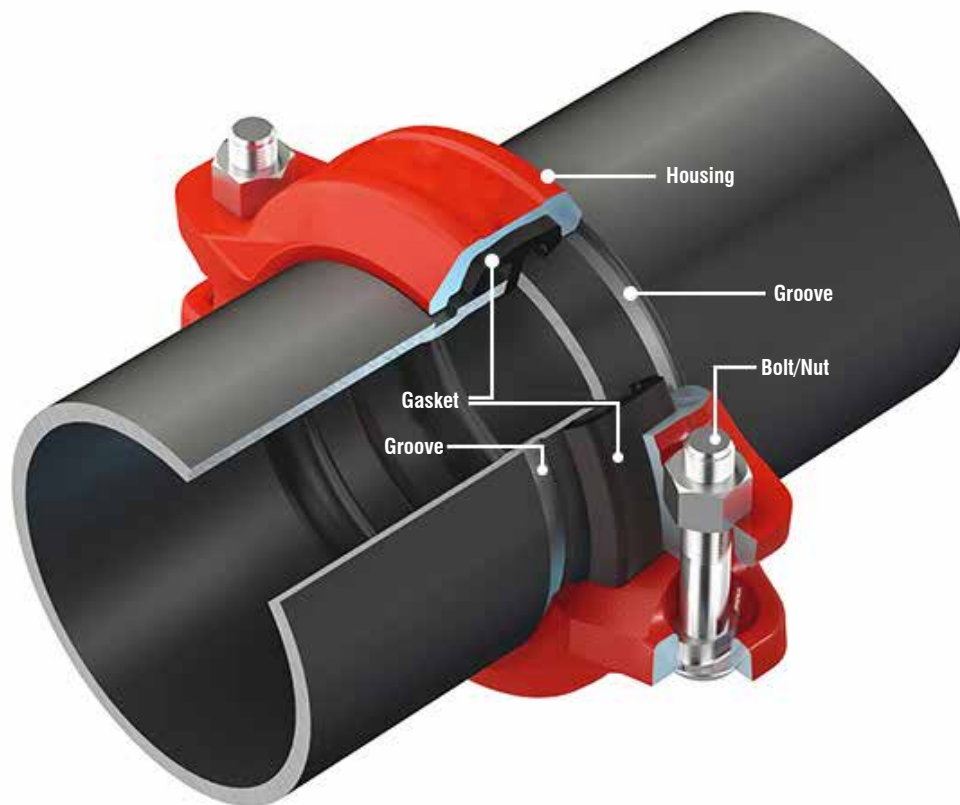
SHIELD Grooved Coupling EPDM Gaskets must be lubricated on the lips and outside back prior to assembly using silicon based non-petroleum lubricant. For more details about lubricant for other types of gasket, please contact us.

# Grooved Fittings

## Mechanical Jointing of Grooved Fitting:

A grooved mechanical pipe joint consists of four elements: grooved-end pipe, a gasket, coupling housing, and fasteners. The pipe groove is made by cold forming or machining a groove into the end of a pipe. A gasket enclosed in the coupling housing is placed around two adjoining grooved pipe ends, and the key section of the housing engages the grooves. The bolts and nuts are tightened with a socket wrench, or impact wrench, holding the housing segments together.

In the installed state, the coupling housing encases the gasket and engages the grooves around the circumference of the pipe to create a leak-tight seal in a self-restrained pipe joint. In addition to pipe-to-pipe joints, grooved couplings can be used to join pipe to grooved-end valves, fittings, and accessories to create a complete piping system.



# Rigid Coupling

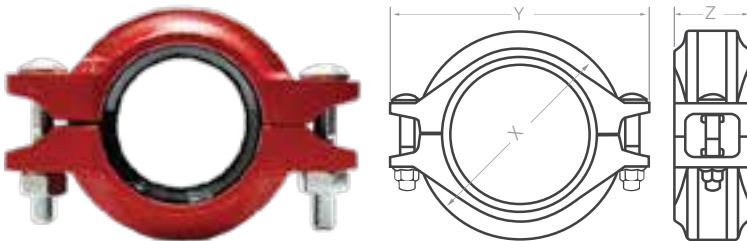
## Standard Coupling:

SDG-22

Nominal Size Inch	Pipe O.D. mm	Maximum Working Pressure PSI	Dimensions			Bolt/Nut No. - Size mm
			X mm	Y mm	Z mm	
1	33.4	500	59.0	100.0	44.00	2 <sup>3</sup> / <sub>8</sub> x 55
1 <sup>1</sup> / <sub>4</sub>	42.2	500	66.0	105.0	45.05	2 <sup>3</sup> / <sub>8</sub> x 55
1 <sup>1</sup> / <sub>2</sub>	48.3	500	72.0	110.0	45.50	2 <sup>3</sup> / <sub>8</sub> x 55
2	60.3	500	86.0	132.5	46.50	2 <sup>3</sup> / <sub>8</sub> x 55
2 <sup>1</sup> / <sub>2</sub>	73.0	500	99.0	154.0	46.50	2 <sup>1</sup> / <sub>2</sub> x 60
3 O.D.	76.1	500	102.5	152.5	46.50	2 <sup>1</sup> / <sub>2</sub> x 70
3	88.9	500	117.0	168.5	46.50	2 <sup>1</sup> / <sub>2</sub> x 75
4	114.3	500	148.0	200.0	52.50	2 <sup>1</sup> / <sub>2</sub> x 75
5 <sup>1</sup> / <sub>2</sub> O.D.	139.7	500	172.0	235.0	52.50	2 <sup>5</sup> / <sub>8</sub> x 85
5	141.3	450	172.0	231.5	52.50	2 <sup>5</sup> / <sub>8</sub> x 85
6 <sup>1</sup> / <sub>2</sub> O.D.	165.1	450	199.5	267.5	53.50	2 <sup>5</sup> / <sub>8</sub> x 85
6	168.3	450	203.0	271.5	53.50	2 <sup>5</sup> / <sub>8</sub> x 85
8	219.1	450	246.5	350.0	61.50	2 <sup>3</sup> / <sub>4</sub> x 115
10	273.0	300	333.0	428.0	63.00	2 <sup>3</sup> / <sub>4</sub> x 115
12	323.9	300	390.0	470.0	63.00	2 <sup>7</sup> / <sub>8</sub> x 140
14	355.6	300	415.0	510.0	72.00	3 <sup>7</sup> / <sub>8</sub> x 140
16	406.4	300	468.0	575.0	72.00	3 <sup>7</sup> / <sub>8</sub> x 140
18	457.0	225	490.0	592.0	72.00	4 <sup>7</sup> / <sub>8</sub> x 140
20	508.0	225	595.0	700.0	76.00	4 <sup>7</sup> / <sub>8</sub> x 140



SHIELD Rigid Coupling provides rigid joints to prevent liner movement of pipe assembly. With a unique ends locked design, SDG22 coupling can be used when the application or design calls for rigid installations.

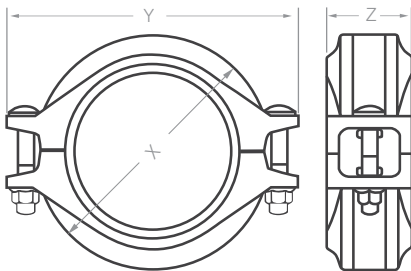


# Rigid Coupling

## Light Coupling:

SDG-20

Nominal Size	Pipe O.D.	Maximum Working Pressure	Dimensions			Bolt/Nut No. - Size
			X mm	Y mm	Z mm	
Inch	mm	PSI				mm
2	60.3	300	87.2	122.5	44	2 <sup>3</sup> / <sub>8</sub> x 2 <sup>1</sup> / <sub>8</sub>
2½	73.0	300	96.8	138.5	44	2 <sup>3</sup> / <sub>8</sub> x 2 <sup>1</sup> / <sub>8</sub>
3 O.D.	76.1	300	100.8	141.5	44	2 <sup>3</sup> / <sub>8</sub> x 2 <sup>1</sup> / <sub>8</sub>
3	88.9	300	113.5	157.5	44	2 <sup>3</sup> / <sub>8</sub> x 2 <sup>3</sup> / <sub>4</sub>
4	114.3	300	142.0	185.5	48	2 <sup>3</sup> / <sub>8</sub> x 2 <sup>3</sup> / <sub>4</sub>
5½ O.D.	139.7	300	168.5	225.5	50	2½ x 3
6½ O.D.	165.1	300	196.0	252.7	50	2½ x 3
6	168.3	300	198.8	256.5	50	2½ x 3
8	219.1	300	256.0	325.0	58	2½ x 75

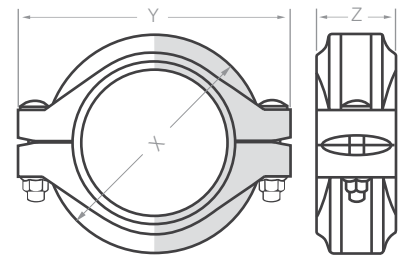


# Flexible Coupling

## Heavy Duty Coupling:

SDG-27

Nominal Size Inch	Pipe O.D. mm	Maximum Working Pressure PSI	Dimensions			Bolt/Nut No. - Size mm
			X mm	Y mm	Z mm	
2	60.3	750	91.0	133	46.5	2½ x 75
2½	73.0	750	104.0	165	46.5	2½ x 75
3 O.D.	76.1	750	107.0	165	46.5	2½ x 75
3	88.9	750	122.0	171	47.0	2½ x 75
4	114.3	750	151.5	213	52.0	2⅝ x 85
5	141.3	700	182.0	241	52.0	2¾ x 115
6½ O.D.	165.1	700	208.0	281	52.0	2¾ x 115
6	168.3	700	210.0	286	52.0	2¾ x 115
8	219.1	600	268.0	354	62.0	2⅞ x 140



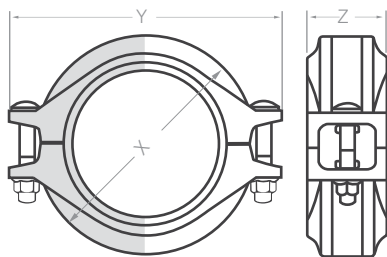
SHIELD Flexible Coupling SDG-27 is a high pressure flexible coupling can be used in different applications where high pressure service is required.

# Flexible Coupling

## Standard Coupling:

SDG-25

Nominal Size	Pipe O.D.	Maximum Working Pressure	Dimensions			Bolt/Nut No. - Size
			X	Y	Z	
Inch	mm	PSI	mm	mm	mm	mm
1¼	42.2	500	66.5	103.0	45.5	2¾ x 55
1½	48.3	500	72.0	108.0	45.0	2¾ x 55
2	60.3	500	84.0	129.0	45.0	2¾ x 55
2½	73.0	500	101.0	142.0	45.5	2¾ x 55
3 O.D.	76.1	500	102.0	147.0	45.5	2¾ x 55
3	88.9	500	116.0	163.5	45.5	2½ x 75
4	114.3	500	145.0	197.0	50.0	2½ x 75
5½ O.D.	139.7	500	169.0	237.5	51.0	2½ x 80
5	141.3	450	169.0	230.0	51.0	2½ x 80
6½ O.D.	165.1	450	196.5	261.5	51.0	2½ x 80
6	168.3	450	201.0	268.0	51.0	2½ x 80
8	219.1	450	260.5	349.5	58.5	2¾ x 115
10	273.0	300	318.0	395.0	63.8	2¾ x 115
12	323.9	300	368.7	458.2	63.6	2¾ x 140
14	355.6	225	428.0	520.0	72.0	3⅞ x 140
16	406.4	225	476.0	570.0	73.0	3⅞ x 140



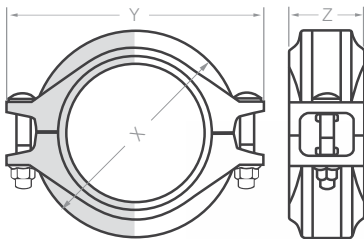
*SHIELD Flexible Couplings allow controlled angular movement of the pipe to assist alignment and installation. The advantage of flexibility must be considered in the design or hanger and support spacing.*

# Flexible Coupling

## Light Coupling:

SDG-21

Nominal Size	Pipe O.D.	Maximum Working Pressure	Dimensions			Bolt/Nut No. - Size
			X	Y	Z	
Inch	mm	PSI	mm	mm	mm	mm
2	60.3	300	85.0	124	46.0	2 <sup>3</sup> / <sub>8</sub> x 55
2½	73.0	300	99.0	137	46.0	2 <sup>3</sup> / <sub>8</sub> x 55
3 O.D.	76.1	300	102.0	140	46.1	2 <sup>3</sup> / <sub>8</sub> x 55
3	88.9	300	115.5	153	46.0	2 <sup>3</sup> / <sub>8</sub> x 70
4	114.3	300	145.0	184	50.5	2 <sup>3</sup> / <sub>8</sub> x 70
5½ O.D.	139.7	300	173.0	225	50.5	2½ x 75
6½ O.D.	165.1	300	199.5	248	50.5	2½ x 80
6	168.3	300	203.0	252	50.5	2½ x 80
8	219.1	300	261.0	399	61.0	2 <sup>5</sup> / <sub>8</sub> x 95



SHIELD SDG-21 is designed for a maximum working pressure of 300psi. The flexibility benefits of this coupling can be used in applications where high pressure is not required.



# Coupling Installation

## Rigid & Flexible Coupling - Installation Instruction:



### 1 Pipe Preparation

- ▶ Check pipe end for proper groove dimensions and to assure that pipe end is free of indentations and projections that would prevent proper sealing.



### 2 Lubricate Gasket

- ▶ Check gasket to be sure it's compatible for the intended service.
- ▶ Apply thin lubricant to the outside and sealing lips of the gasket.



### 3 Gasket Installation

- ▶ Slip the gasket over one pipe, making sure the gasket lip does not over-hang the pipe end.



### 4 Alignment

- ▶ After aligning two pipe ends together, pull the gasket into position, centring between the grooves on each pipe.
- ▶ The gasket should not extend into the groove on either pipe.



### 5 Housing Installation

- ▶ Remove one bolt & nut and loosen the other nut. Place one housing over the gasket, making sure the housing keys fit into the pipe grooves.
- ▶ Swing the other housing over the gasket and into the grooves on both pipes.
- ▶ Re-insert the bolt and connect two housings.



### 6 Tighten Nuts

- ▶ Firstly hand tighten nuts and make sure oval neck bolt completely fits into bolt hole.
- ▶ Then securely tighten nuts alternatively and equally to the specified bolt torque by using spanner.

# Coupling Installation

## Rigid & Flexible Coupling - Installation Instruction:



### Assembly Completed - Rigid Coupling

- ▶ For Rigid Coupling, keep the gaps at bolt pads evenly spaced. Gaskets can't be seen visually.



### Assembly Completed - Flexible Coupling

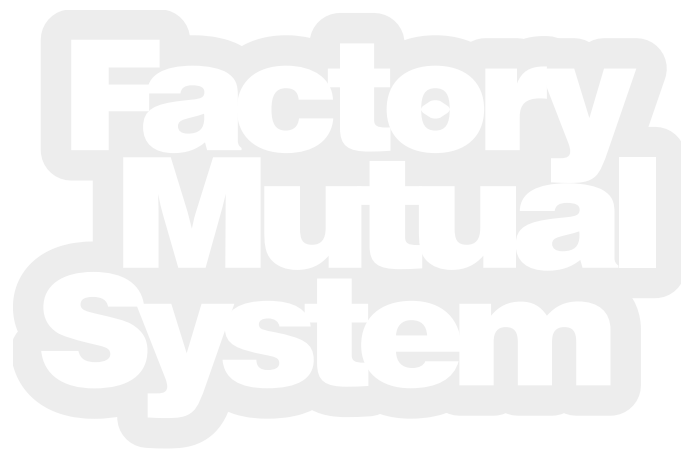
- ▶ For Flexible Coupling, two housings should be iron to iron connected. Gaskets can't be seen visually.



## Specified Bolt Torque:

ANSI Bolts

Bolt Size	Dimensions	
	Inch	Lbs./ft.
3/8	30/45	40-60
1/2	80/100	110-135
5/8	100/130	135-175
3/4	130/180	175-245
7/8	180/240	245-325



## CAUTION

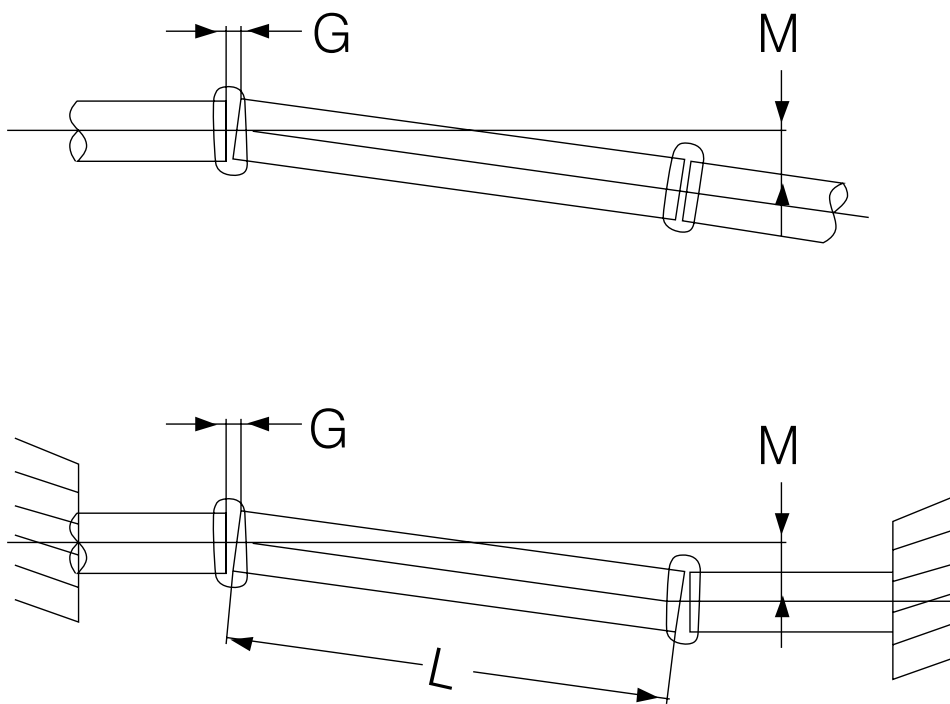
- ▶ Proper torquing of bolts is required to obtain specified performance.
- ▶ Over torquing the bolts may result in damage to the bolt and/or casting which could result in pipe joint separation.
- ▶ Under torquing the bolts may result in lower pressure retention capabilities, lower bend load capabilities, joint leakage and pipe joint separation. Pipe joint separation may result in significant property damage and serious injury.

NOTE: Refer to UL/FM certificates for more details.

# Misalignment & Deflections

The angular movement capability of the flexible coupling permits the assembly of pipe joints where the piping is not properly aligned. At least two couplings are required to provide for lateral pipe misalignment. Deflection (longitudinal misalignment) may be accommodated within a single coupling as long as the angle of deflection does not exceed the value shown in the coupling performance data for the particular size and coupling type.

A pipe joint that utilizes the angular deflection capability of the coupling will react to pressure and thermal forces dependent upon the manner in which it is restrained. An unrestrained joint will react to these forces by straightening, thus reducing, if not eliminating, the deflection at the joint. If joint deflection has been designed into the pipe layout and must be maintained, then sufficient anchors must be provided to resist the lateral forces and hold the joint in the deflected condition.



The amount of deflection from pipe run centreline can be calculated utilizing the following equations:

$$M = L \sin \Theta$$

$$\Theta = \sin^{-1} (G \div D)$$

$$M = (G \div D) \times L$$

Where:

M = Misalignment (inches)

G = Maximum Allowable Pipe End Movement (Inches)

$\Theta$  = Maximum Deflection (Degrees) from centreline

D = Pipe Outside Diameter (Inches)

L = Pipe Length (Inches)

# Anchoring & Support

When designing the hangers, supports and anchors for a grooved end pipe system, the piping designer must consider certain unique characteristics of the grooved type coupling in addition to many universal pipe hanger and support design factors. As with any pipe system, the hanger or support system must provide for

- 1) the weight of the pipe, couplings, fluid and pipe system components;
- 2) reduce stresses at pipe joints; and
- 3) permit required pipe system movement to relieve stress.

The following chart shows the maximum span between pipe hangers, supports and anchors.

## Max. Span between Supports (steel pipe)

Nominal Size mm	Maximum Span Between Supports	
	Insulating Pipe mm	Non-Insulating Pipe mm
15	2.5	2.0
20	3.0	2.5
25	3.5	2.5
35	4.0	2.5
40	4.5	3.0
50	5.0	3.0
70	6.0	4.0
80	6.0	4.0
100	6.5	4.5
125	7.0	6.0
150	8.0	7.0
200	9.5	7.0
250	11.0	8.0
300	12.0	8.5

# Curve Layout

Utilizing the angular deflection at each coupling joint curves may be laid out using straight pipe lengths and Couplings.

This example shows how to calculate the curve radius, required pipe lengths, and number of required couplings.

$$R = L / (2 \times \sin(\Theta/2))$$

$$L = 2 \times R \times \sin(\Theta/2)$$

$$N = T / \Theta$$

WHERE:

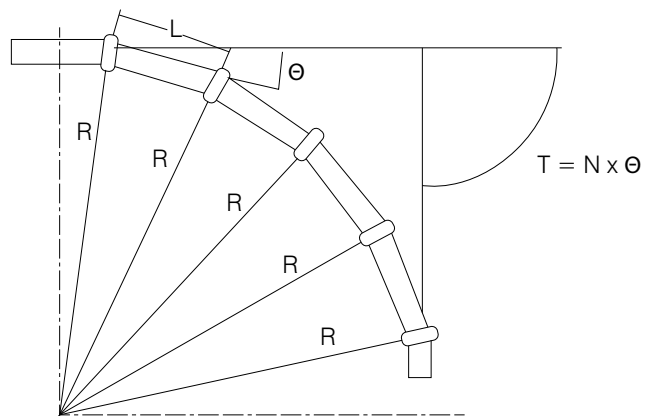
N = Number of Couplings

R = Radius of Curve (feet)

L = Pipe Length (feet)

Θ = Deflection from centreline (Degrees) of each Coupling

T = Total Angular Deflection of all Couplings.



# Movements

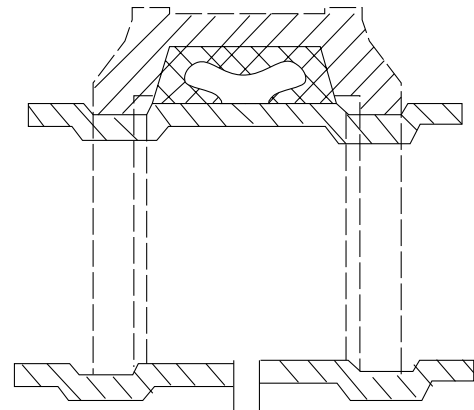
Each flexible design coupling can provide for pipe system movement up to the design maximum for the specific size and type coupling being utilized. Movement is possible in the coupling due to two factors:

- (1) designed-in clearance between the key of the coupling and the groove diameter and groove width, and
- (2) the gap between pipe ends joined by the coupling.

## Linear Movement

Linear movement is accommodated within the coupling by allowing the pipe ends to move together or apart in response to pressure thrusts and temperature changes. The available linear movement provided by couplings is shown below:

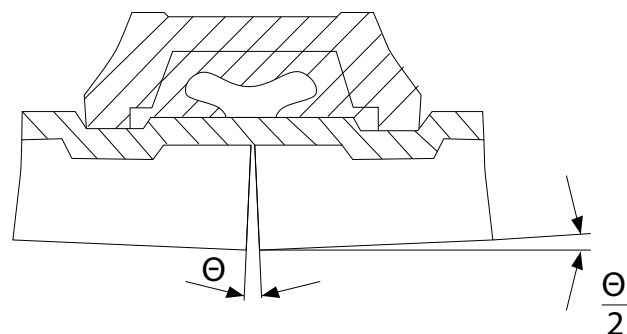
Size		Movement (Cut)	Movement (Roll)
Inch	mm	mm	mm
1 - 1¼	25 - 32	0 - 4.0	0 - 3.0
1½ - 12	40 - 300	0 - 6.4	0 - 5.0



## Angular Movement

Designed-in clearances allow limited deflection of the pipe joint within the coupling, without introducing eccentric loads into the coupling joint.

The maximum available angular movement of coupling joints is shown in the performance data for each coupling type. The amount of angular flexibility varies for each coupling size and type. For design purposes the published figures should be reduced by the below listed factors to account for pipe, groove and coupling tolerances.

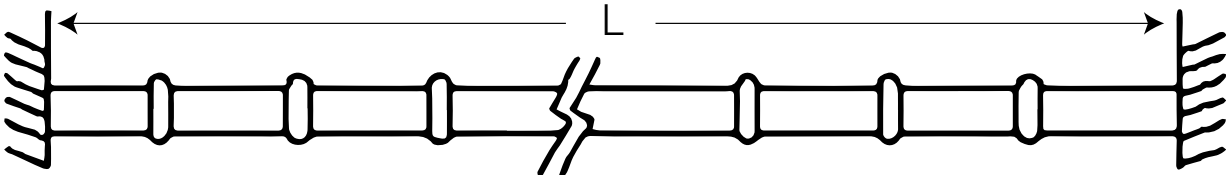


Size	Design Factor
Inch	Inch
1 - 3	Reduce to 50%
4-12	Reduce to 75%

# Movement Applications

## Thermal Stress

Thermal stress is caused by changes in temperature, resulting in either expansion or contraction. When designing a system you must allow for this thermal movement. To determine the appropriate number of flexible couplings to allow for this thermal movement please refer to the following.



Example:

- 4" straight steel pipe, 30m long
- Anchored on both ends
- Minimum temperature (during installation) = 5°C
- Maximum working temperature = 55°C

From the thermal expansion table, we know the overall pipeline length will increase by 18mm (0.71"). You can also use Formula 1 or Table 3 to find the amount of thermal expansion. We want to know the number of couplings that are required to address this thermal movement problem.

The allowed movement of a 4" flexible coupling is :  
Movement range x Adjustment = Allowed movement  
 $4.3\text{mm} \times 75\% = 3.2\text{mm}$

The appropriate number of coupling is:  
Thermal expansion / Allowed movement = Number of couplings  
 $18\text{mm} / 3.2\text{mm} = 5.6$

Conclusion:

The appropriate number of coupling is 6.

# Movement Applications

## Thermal Expansion

Temperature Difference (°C)	Pipe Length (m)					
	1	5	10	20	30	40
	Thermal Expansion (mm)					
1	0.012	0.060	0.120	0.240	0.360	0.480
5	0.060	0.300	0.600	1.200	1.800	2.400
10	0.120	0.600	1.200	2.400	3.600	4.800
20	0.240	1.200	2.400	4.800	7.200	9.600
30	0.360	1.800	3.600	7.200	11.000	15.000
40	0.480	2.400	4.800	9.600	14.000	20.000
50	0.600	3.000	6.000	12.000	18.000	24.000
60	0.720	3.600	7.200	14.000	22.000	29.000
70	0.840	4.200	8.400	17.000	25.000	34.000
80	0.960	4.800	9.600	19.000	29.000	39.000

### Thermal Expansion Formula 1

$$\lambda = \alpha \times L \times T$$

$\lambda$  : Thermal Expansion

$\alpha$  : Linear Expansion

Coefficient for steel

L: Pipe length

T: Temperature difference

# Allowance for Pipe Movement

Model Number	Description	Pipe OD	Nominal Pipe Size	Maximum Movement Allowed		
				Cut Groove		
				Angular Movement Each Meter		Linear Movement
				Degree	mm	mm
SDG 25	Flexible Coupling	33.7	25	2°-45'	48	2.0
		42.4	32	2°-10'	38	2.0
		48.3	40	1°-54'	33	3.2
		60.3	50	1°-31'	26	3.2
		76.1	65	1°-12'	21	3.2
		88.9	80	1°-02'	18	3.2
		114.3	100	1°-36'	28	3.2
		141.3	125	1°-03'	18	3.2
		168.3	150	1°-05'	19	3.2
		219.1	200	0°-50'	15	3.2
		273.0	250	0°-40'	12	3.2
323.9	300	0°-34'	10	3.2		

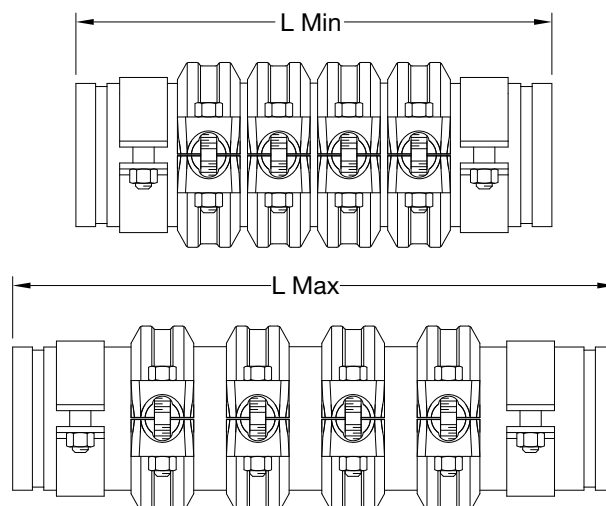
Model Number	Description	Pipe OD	Nominal Pipe Size	Maximum Movement Allowed		
				Roll Groove		
				Angular Movement Each Meter		Linear Movement
				Degree	mm	mm
SDG 25	Flexible Coupling	33.7	25	1°-22'	24.0	1.0
		42.4	32	1°-05'	19.0	1.0
		48.3	40	0°-57'	16.5	1.6
		60.3	50	0°-45'	13.0	1.6
		76.1	65	0°-36'	10.5	1.6
		88.9	80	0°-31'	9.0	1.6
		114.3	100	0°-48'	14.0	1.6
		141.3	125	0°-30'	9.0	1.6
		168.3	150	0°-32'	9.5	1.6
		219.1	200	0°-25'	7.5	1.6
		273.0	250	0°-20'	6.0	1.6
323.9	300	0°-18'	5.0	1.6		



# Expansion Joint

Model Number	Size	Pipe OD	Maximum Expansion	L Min	L Max	Quantity of Coupling	Pressure
	Inch	mm	mm	mm	mm		
Flexible Coupling SDG 25	1"	33.7	45	617	662	10	500
	1¼"	42.4	45	617	662	10	500
	1½"	48.3	45	617	662	10	500
	2"	60.3	45	617	662	10	500
	2½"	73.0	45	617	662	10	500
	3" OD	76.1	45	617	662	10	500
	3"	88.9	45	617	662	10	500
	4"	114.3	47	503	550	7	500
	5½" OD	139.7	47	503	550	7	500
	5"	141.3	47	503	550	7	500
	6½" OD	165.1	52	591	643	7	500
	6"	168.3	52	591	643	7	500
	8"	219.1	52	591	643	7	500
	10"	273.0	52	591	643	7	500
12"	323.9	52	591	643	7	500	

NOTE: Above results based on using SCH 40 steel pipe.

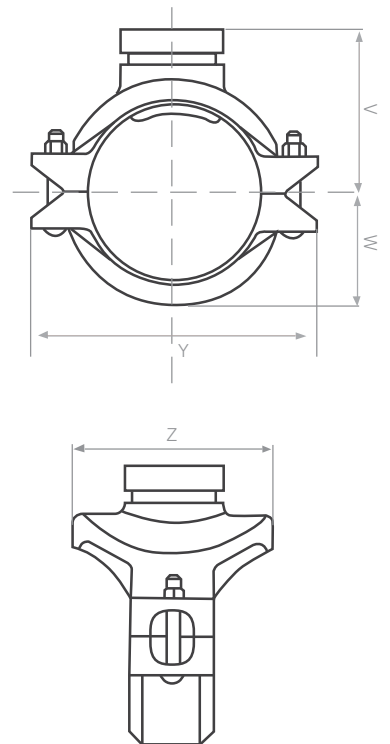


# Grooved Outlet

## Mechanical Tee:

SDG-44

Nominal Size	Pipe O.D.	Maximum Working Pressure	Hole Diameter +1.6	Dimensions				Bolt/Nut No - Size
				Y mm	Z mm	V mm	W mm	
2½ x 1¼	73.0 x 42.2	300	51	144	84.5	75.0	49.0	½ x 60
3 x 2	88.9 x 60.3	300	64	160	104.0	92.0	53.5	½ x 75
4 x 2	114.3 x 60.3	300	64	186	104.4	101.5	68.0	½ x 75
4 x 2½	114.3 x 73	300	70	186	104.4	101.5	68.0	½ x 75
4 x 3 O.D.	114.3 x 76.1	300	70	186	104.4	101.5	68.0	½ x 75
4 x 3	114.3 x 88.9	300	89	186	124.0	101.5	68.0	½ x 75
5½ O.D. x 2	139.7 x 60.3	300	70	226	114.0	119.0	81.0	⅝ x 85
5½ O.D. x 3 O.D.	139.7 x 76.1	300	70	226	114.0	119.0	81.0	⅝ x 85
5½ O.D. x 3	139.7 x 88.9	300	89	226	136.0	122.0	81.0	⅝ x 85
6½ O.D. x 2	165.1 x 60.3	300	64	242	112.0	127.5	95.0	⅝ x 110
6½ O.D. x 3 O.D.	165.1 x 76.1	300	70	242	112.0	127.5	95.0	⅝ x 110
6½ O.D. x 3	165.1 x 88.9	300	89	242	142.6	141.0	95.0	⅝ x 110
6½ O.D. x 4	165.1 x 114.3	300	114	242	157.0	141.0	95.0	⅝ x 110
6 x 2	168.3 x 60.3	300	64	246	114.0	134.0	98.5	⅝ x 110
6 x 4	168.3 x 114.3	300	114	246	157.0	142.0	98.5	⅝ x 110
8 x 2	219.1 x 60.3	300	70	320	118.0	158.0	123.0	¾ x 115
8 x 3 O.D.	219.1 x 76.1	300	70	320	118.0	158.0	123.0	¾ x 115
8 x 3	219.1 x 88.9	300	89	320	142.0	161.0	123.0	¾ x 115
8 x 4	219.1 x 114.3	300	114	320	170.0	162.0	123.0	¾ x 115



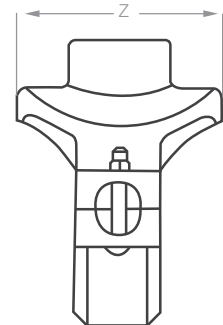
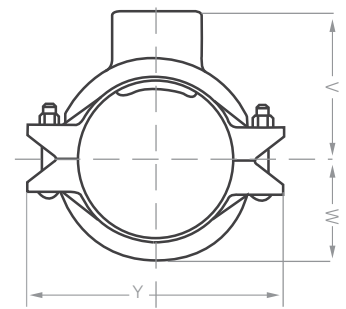
# Threaded Outlet

## Mechanical Tee:

SDG-42

Nominal Size	Pipe O.D.	Maximum Working Pressure	Hole Diameter +1.6	Dimensions				Bolt/Nut No - Size
				Y mm	Z mm	V mm	W mm	
Inch	mm	PSI	mm					Inch
2 x 1	60.3 x 33.4	300	38	116	68.0	60.0	39.0	3/8 x 55
2 x 1 1/4	60.3 x 42.2	300	45	116	76.0	62.0	39.0	3/8 x 55
2 x 1 1/2	60.3 x 48.3	300	45	116	76.0	62.0	39.0	3/8 x 55
2 1/2 x 3/4	73.0 x 26.9	300	38	144	70.0	69.0	49.0	1/2 x 60
2 1/2 x 1	73.0 x 33.4	300	38	144	70.0	69.0	49.0	1/2 x 60
2 1/2 x 1 1/4	73.0 x 42.2	300	51	144	84.5	73.0	49.0	1/2 x 60
2 1/2 x 1 1/2	73.0 x 48.3	300	51	144	84.5	73.0	49.0	1/2 x 60
3 O.D. x 1	76.1 x 33.4	300	38	144	72.0	77.5	46.5	1/2 x 75
3 O.D. x 1 1/4	76.1 x 42.2	300	51	144	84.5	77.5	46.5	1/2 x 75
3 O.D. x 1 1/2	76.1 x 48.3	300	51	144	90.5	79.5	46.5	1/2 x 75
3 x 1	88.9 x 33.4	300	38	160	73.5	80.0	53.5	1/2 x 75
3 x 1 1/4	88.9 x 42.2	300	51	160	85.5	80.0	53.5	1/2 x 75
3 x 1 1/2	88.9 x 48.3	300	51	160	90.0	80.0	53.5	1/2 x 75
3 x 2	88.9 x 60.3	300	64	160	104.0	80.0	53.5	1/2 x 75
4 x 1/2	114.3 x 21.3	300	42	186	78.4	93.0	68.0	1/2 x 75
4 x 3/4	114.3 x 26.9	300	42	186	89.0	93.0	68.0	1/2 x 75
4 x 1	114.3 x 33.4	300	38	186	89.0	93.0	68.0	1/2 x 75
4 x 1 1/4	114.3 x 42.2	300	51	186	89.0	95.0	68.0	1/2 x 75
4 x 1 1/2	114.3 x 48.3	300	51	186	104.4	97.0	68.0	1/2 x 75
4 x 2	114.3 x 60.3	300	64	186	104.4	120.0	68.0	1/2 x 75
4 x 2 1/2	114.3 x 73	300	70	186	124.0	100.0	68.0	1/2 x 75
4 x 3	114.3 x 88.9	300	89	208	96.5	100.0	68.0	1/2 x 75
5 1/2 O.D. x 1	139.7 x 33.4	300	51	226	95.0	110.0	81.0	5/8 x 85
5 1/2 O.D. x 1 1/4	139.7 x 42.2	300	51	226	95.0	114.0	81.0	5/8 x 85
5 1/2 O.D. x 1 1/2	139.7 x 48.3	300	51	226	95.0	112.0	81.0	5/8 x 85
5 1/2 O.D. x 2	139.7 x 60.3	300	70	226	114.0	114.0	81.0	5/8 x 85
5 1/2 O.D. x 3 O.D.	139.7 x 76.1	300	70	226	114.0	119.0	81.0	5/8 x 85
5 1/2 O.D. x 3	139.7 x 88.9	300	89	226	136.0	122.0	81.0	5/8 x 85
5 x 1 1/4	141.3 x 42.2	300	51	226	98.0	110.0	81.0	5/8 x 85
6 1/2 O.D. x 1/2	165.1 x 21.3	300	42	242	80.5	110.0	95.0	5/8 x 110
6 1/2 O.D. x 3/4	165.1 x 26.9	300	42	242	80.5	110.0	95.0	5/8 x 110
6 1/2 O.D. x 1	165.1 x 33.4	300	38	242	78.0	118.0	95.0	5/8 x 110
6 1/2 O.D. x 1 1/4	165.1 x 42.2	300	51	242	93.0	118.0	95.0	5/8 x 110
6 1/2 O.D. x 1 1/2	165.1 x 48.3	300	51	242	93.0	118.0	95.0	5/8 x 110
6 1/2 O.D. x 2	165.1 x 60.3	300	64	242	112.0	128.5	95.0	5/8 x 110
6 1/2 O.D. x 3 O.D.	165.1 x 76.1	300	70	242	112.0	128.0	95.0	5/8 x 110
6 1/2 O.D. x 3	165.1 x 88.9	300	89	242	132.0	128.5	95.0	5/8 x 110
6 1/2 O.D. x 4	165.1 x 114.3	300	114	242	157.0	141.0	95.0	5/8 x 110

(Cont.)



# Threaded Outlet

SDG-42

Nominal Size	Pipe O.D.	Maximum Working Pressure	Hole Diameter + 1.6	Dimensions				Bolt/Nut No - Size
				Y mm	Z mm	V mm	W mm	
Inch	mm	PSI	mm					Inch
6 x 1¼	168.3 x 42.4	300	51	240	92.5	115.0	96.5	⅝ x 105
6 x 1½	168.3 x 48.3	300	51	240	92.5	115.0	96.5	⅝ x 105
6 x 2	168.3 x 60.3	300	64	246	114.0	135.0	98.5	⅝ x 110
6 x 2½	168.3 x 73.0	300	70	246	115.0	134.0	98.5	⅝ x 110
6 x 4	168.3 x 114.3	300	114	246	157.0	141.0	98.5	⅝ x 110
8 x 1	219.0 x 33.4	300	51	320	96.5	150.0	123.0	⅝ x 115
8 x 1¼	219.1 x 42.2	300	51	320	96.5	150.0	123.0	⅝ x 115
8 x 1½	219.1 x 48.3	300	51	320	96.5	150.0	123.0	⅝ x 115
8 x 2	219.1 x 60.3	300	70	320	118.0	158.5	123.0	⅝ x 115
8 x 2½	219.1 x 73.0	300	70	320	118.0	158.5	123.0	⅝ x 115
8 x 3	219.1 x 88.9	300	89	320	142.0	161.0	123.0	⅝ x 115
8 x 4	219.1 x 114.3	300	114	320	170.0	170.0	123.0	⅝ x 115



“SHIELD Mechanical Tees allow a direct branch connection to be made on a pipe run where sufficient space allows a hole to be cut. Material: Ductile Iron ASTM A536. Gasket Standard EPDM. Threads are available to BSPT or NPT and can be supplied in red coating or hot dipped galvanized.”

The mechanical tee and cross features a gap between the bolt pads. Do not attempt to bring bolt pads together, which would result in metal to metal when tightening bolts and nuts. Note that excessive torque may cause joint failure - the following table provides recommended bolt fastening torque.

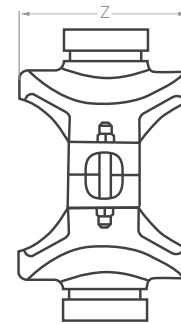
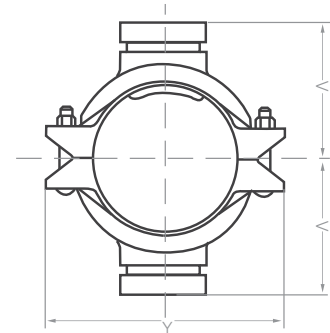
Bolt Size	Recommended Bolt Torque N - m
⅜	40 ~ 60
½	110 ~ 135
⅝	135 ~ 175
¾	175 ~ 245
⅞	245 ~ 325

# Mechanical Cross

## Grooved:

SDG-49

Nominal Size	Pipe O.D.	Maximum Working Pressure	Hole Diameter +1.6	Dimensions			Bolt/Nut No - Size
				Y mm	Z mm	V mm	
Inch	mm	PSI	mm				Inch
2½ x 1¼	73.0 x 42.4	300	51	144.0	84.5	75.0	½ x 70
3 O.D. x 1	76.1 x 33.7	300	38	137.0	71.0	78.0	½ x 70
3 O.D. x 1¼	76.1 x 42.4	300	51	137.0	84.5	78.0	½ x 70
3 x 1	88.9 x 33.7	300	38	152.0	72.5	84.5	½ x 75
3 x 1¼	88.9 x 42.4	300	51	152.0	85.5	84.5	½ x 75
3 x 2½	88.9 x 48.3	300	51	152.0	85.5	84.5	½ x 75
4 x 1	114.3 x 33.7	300	38	188.0	78.4	102.0	½ x 75
4 x 1½	114.3 x 48.3	300	51	188.0	89.0	102.0	½ x 75
4 x 2	114.3 x 60.3	300	64	188.0	104.5	102.0	½ x 75
5½ O.D. x 2	139.7 x 60.3	300	64	221.5	112.5	118.0	5⁄8 x 85
5½ O.D. x 3 O.D.	139.7 x 76.1	300	70	221.5	112.5	118.0	5⁄8 x 85
6½ O.D. x 2	165.1 x 60.3	300	64	244.0	112.5	127.0	5⁄8 x 105
6½ O.D. x 3 O.D.	165.1 x 76.1	300	70	244.0	112.5	127.0	5⁄8 x 105
6½ O.D. x 3	165.1 x 88.9	300	89	244.0	132.0	141.0	5⁄8 x 105
6 x 1½	168.3 x 48.3	300	51	247.0	95.0	128.0	5⁄8 x 105
6 x 2	168.3 x 60.3	300	64	247.0	114.0	134.0	5⁄8 x 105
6 x 2½	168.3 x 73.0	300	70	247.0	115.0	134.0	5⁄8 x 105
6 x 3	168.3 x 88.9	300	89	247.0	132.0	141.0	5⁄8 x 105
8 x 2	219.1 x 60.3	300	64	320.0	118.0	158.0	¾ x 115
8 x 3 O.D.	219.1 x 76.1	300	70	320.0	118.0	158.0	¾ x 115
8 x 3	219.1 x 88.9	300	89	320.0	136.5	161.0	¾ x 115
8 x 4	219.1 x 114.3	300	114	320.0	162.0	161.0	¾ x 115
10 x 3 O.D.	273.0 x 76.1	300	70	376.0	118.0	189.0	¾ x 120
10 x 3	273.0 x 88.9	300	89	376.0	136.5	189.0	¾ x 120
10 x 4	273.0 x 114.3	300	114	376.0	164.0	189.0	¾ x 120

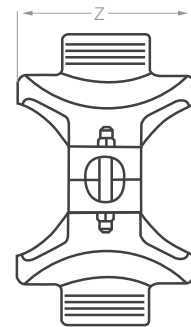
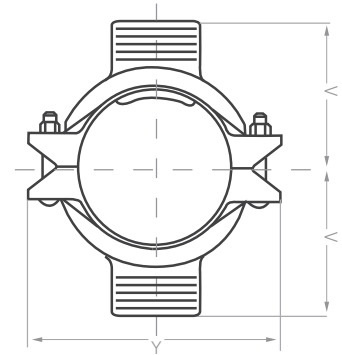


# Mechanical Cross

## Threaded:

SDG-47

Nominal Size	Pipe O.D.	Maximum Working Pressure	Hole Diameter +1.6	Dimensions			Bolt/Nut No - Size
				Y mm	Z mm	V mm	
Inch	mm	PSI	mm				Inch
2 x 1	60.3 x 33.4	300	38	116	68.0	60.0	5/8 x 55
2 x 1 1/4	60.3 x 42.2	300	45	116	76.0	62.0	5/8 x 55
2 x 1 1/2	60.3 x 48.3	300	45	116	76.0	62.0	5/8 x 55
2 1/2 x 3/4	73.0 x 26.9	300	38	144	70.0	69.0	1/2 x 75
2 1/2 x 1	73.0 x 33.4	300	38	144	70.0	69.0	1/2 x 75
2 1/2 x 1 1/4	73.0 x 42.2	300	51	144	84.5	73.0	1/2 x 75
2 1/2 x 1 1/2	73.0 x 48.3	300	51	144	84.5	73.0	1/2 x 75
3 O.D. x 1	76.1 x 33.4	300	38	144	72.0	77.5	1/2 x 75
3 O.D. x 1 1/4	76.1 x 42.2	300	51	144	84.5	77.5	1/2 x 75
3 O.D. x 1 1/2	76.1 x 48.3	300	51	144	90.5	79.5	1/2 x 75
3 x 1	88.9 x 33.4	300	51	160	73.5	80.0	1/2 x 75
3 x 1 1/4	88.9 x 42.2	300	51	160	85.5	80.0	1/2 x 75
3 x 1 1/2	88.9 x 48.3	300	51	160	90.0	80.0	1/2 x 75
3 x 2	88.9 x 60.3	300	64	160	104.0	80.0	1/2 x 75
4 x 1/2	114.3 x 21.3	300	42	186	78.4	93.0	1/2 x 75
4 x 3/4	114.3 x 26.9	300	42	186	78.4	93.0	1/2 x 75
4 x 1	114.3 x 33.4	300	38	186	89.0	93.0	1/2 x 75
4 x 1 1/4	114.3 x 42.2	300	51	186	87.9	95.0	1/2 x 75
4 x 1 1/2	114.3 x 48.3	300	51	186	89.0	97.0	1/2 x 75
4 x 2	114.3 x 60.3	300	64	186	104.4	100.0	1/2 x 75
4 x 2 1/2	114.3 x 73	300	70	186	104.4	100.0	1/2 x 75
4 x 3 O.D.	114.3 x 76.1	300	70	186	104.4	100.0	1/2 x 75
4 x 3	114.3 x 88.9	300	89	186	124.0	100.0	1/2 x 75
5 1/2 O.D. x 1	139.7 x 33.4	300	51	226	95.0	110.0	5/8 x 85
5 1/2 O.D. x 1 1/4	139.7 x 42.2	300	51	226	95.0	114.0	5/8 x 85
5 1/2 O.D. x 1 1/2	139.7 x 48.3	300	51	226	95.0	112.0	5/8 x 85
5 1/2 O.D. x 2	139.7 x 60.3	300	70	226	114.0	114.0	5/8 x 85
5 1/2 O.D. x 3 O.D.	139.7 x 76.1	300	70	226	114.0	119.0	5/8 x 85
6 1/2 O.D. x 3/4	165.1 x 26.9	300	42	242	80.5	120.0	5/8 x 110
6 1/2 O.D. x 1	165.1 x 33.4	300	38	242	78.0	118.0	5/8 x 110
6 1/2 O.D. x 1 1/4	165.1 x 42.2	300	51	242	93.0	118.0	5/8 x 110
6 1/2 O.D. x 1 1/2	165.1 x 48.2	300	51	242	93.0	118.0	5/8 x 110
6 1/2 O.D. x 2	165.1 x 60.3	300	64	242	112.0	128.5	5/8 x 110
6 1/2 O.D. x 3 O.D.	165.1 x 76.1	300	70	242	112.0	128.5	5/8 x 110
6 x 2	168.3 x 60.3	300	64	246	114.0	135.0	5/8 x 110
6 x 2 1/2	168.3 x 73.0	300	70	246	115.0	134.0	5/8 x 110
8 x 1	219.1 x 33.4	300	51	320	96.5	150.0	5/8 x 110
8 x 1 1/4	219.0 x 42.2	300	51	320	96.5	150.0	3/4 x 115
8 x 1 1/2	219.1 x 48.3	300	51	320	96.5	150.0	3/4 x 115
8 x 2	219.1 x 60.3	300	70	320	118.0	150.0	3/4 x 115
8 x 3 O.D.	219.1 x 76.1	300	70	320	118.0	158.5	3/4 x 115

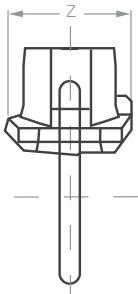
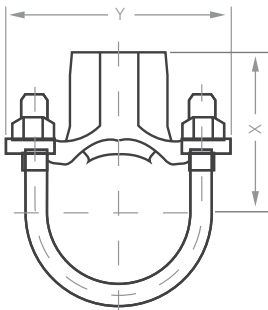


# Mechanical Cross

## Threaded:

SDG-40

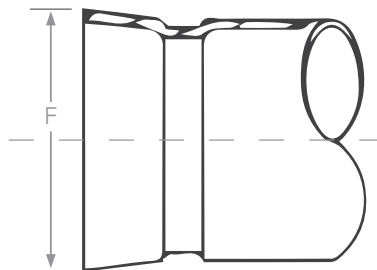
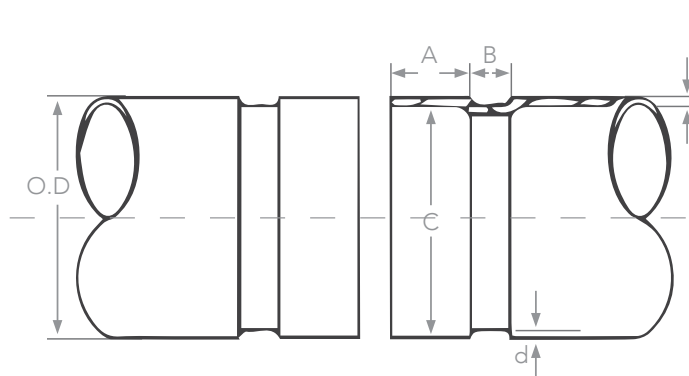
Nominal Size Inch	Pipe O.D. mm	Maximum Working Pressure PSI	Dimensions			U-Bolt Size mm
			X mm	Y mm	Z mm	
1¼ x ½	30	300	53	89	56	¾ x 60
1¼ x ¾	30	300	53	89	56	¾ x 60
1¼ x 1	30	300	56	89	56	¾ x 60
1½ x ½	30	300	55	89	56	¾ x 67
1½ x ¾	30	300	55	89	56	¾ x 67
1½ x 1	30	300	58	89	56	¾ x 67
2 x ½	30	300	64	98	56	¾ x 82
2 x ¾	30	300	64	98	56	¾ x 82
2 x 1	30	300	67	98	56	¾ x 82
2½ x ½	30	300	69	111	56	¾ x 95
2½ x ¾	30	300	69	111	56	¾ x 95
2½ x 1	30	300	72	111	56	¾ x 95



# Grooved Dimensions

## Technical Data:

Nominal Size Inch	Pipe O.D.			Gasket Seat 'A' (±) 0.030	Grooved Diameter 'C'		Grooved Width 'B'		Grooved Depth 'D'	Minimum Pipe Wall Thickness 'T'		Max. 'F' Flare Diameter Roll Groove
	Actual	Tolerance (+) (-)			Maximum	Tolerance (±) 0.000	Roll Groove (±) 0.030	Cut Groove (±) 0.031		Roll Groove	Cut Groove	
1¼	1.660	0.016	0.016	0.625	1.535	-0.015	0.281	0.312	0.063	0.065	0.140	1.77
1½	1.900	0.019	0.019	0.625	1.775	-0.015	0.281	0.312	0.063	0.065	0.140	2.01
2	2.375	0.024	0.024	0.625	2.250	-0.015	0.344	0.312	0.063	0.065	0.154	2.48
2½	2.875	0.029	0.029	0.625	2.720	-0.018	0.344	0.312	0.078	0.083	0.187	2.98
3 O.D.	3.000	0.030	0.030	0.625	2.845	-0.018	0.344	0.312	0.078	0.083	0.188	3.10
3	3.500	0.035	0.031	0.625	3.344	-0.018	0.344	0.312	0.078	0.083	0.188	3.60
4	4.500	0.045	0.031	0.625	4.334	-0.020	0.344	0.312	0.083	0.083	0.203	4.60
5½	5.500	0.056	0.031	0.625	5.334	-0.020	0.344	0.375	0.083	0.109	0.203	5.60
5	5.563	0.056	0.031	0.625	5.395	-0.022	0.344	0.375	0.084	0.109	0.203	5.66
6	6.625	0.063	0.031	0.625	6.445	-0.022	0.344	0.375	0.085	0.109	0.219	6.73
8	8.625	0.063	0.031	0.750	8.441	-0.025	0.469	0.375	0.092	0.109	0.238	8.80
10	10.750	0.063	0.031	0.750	10.562	-0.027	0.469	0.500	0.094	0.134	0.250	10.92
12	12.750	0.063	0.031	0.750	12.531	-0.030	0.469	0.500	0.109	0.156	0.279	12.17
14	14.000	0.063	0.031	0.750	13.781	-0.030	0.469	0.500	0.109	0.156	0.281	14.10
16	16.000	0.063	0.031	0.750	15.781	-0.030	0.469	0.500	0.109	0.165	0.312	16.10
18	18.000	0.060	0.030	1.000	17.781	-0.025	0.469	0.500	0.109	0.165	0.312	18.16
20	20.000	0.060	0.030	1.000	19.781	-0.025	0.469	0.500	0.109	0.188	0.312	20.16





# Threaded & Grooved Outlet

## Threaded & Grooved Mechanical Tee - Installation Instruction:



### Pipe Preparation

- ▶ Clean the gasket sealing surface within 16mm of the hole.
- ▶ Visually inspect the sealing surface for defects that may prevent proper sealing of the gasket.
- ▶ Don't drill the hole on weld line.



### Remove Burrs

- ▶ If any burrs or slug exists at the pipe hole, please remove them before assembly, to protect the gasket and avoid leakage.



### Gasket Installation

- ▶ Insert the gasket into outlet housing making sure the tab in the gasket line up with the tab recesses in the housing.
- ▶ Align outlet housing over the pipe hole making sure that the locating collar is in the pipe hole.



### Alignment

- ▶ Align the strap around the pipe, insert the bolts and tighten the nuts finger tight.



### Tighten Nuts

- ▶ Alternatively and evenly tighten the nuts to the specified bolt torque.



### Assembly Completed

- ▶ There should be even gaps on two sides between upper and lower housings.

## ANSI Bolts

Bolt Size	Dimensions	
	Inch	Lbs/ft.
3/8	30/45	40-60
1/2	80/100	110-135
5/8	-	-
3/4	-	-
7/8	-	-

NOTE: Refer to UL/FM certificates for more details.

SHIELD reserves the right to change the contents without notice.

## CAUTION

- ▶ Proper torquing of bolts is required to obtain specified performance.
- ▶ Over torquing the bolts may result in damage to the bolt and/or casting which could result in pipe joint separation.
- ▶ Under torquing the bolts may result in lower pressure retention capabilities, lower bend load capabilities, joint leakage and pipe joint separation. Pipe joint separation may result in significant property damage and serious injury.

# Safety Datasheet

## 1 - Chemical Composition

Elements	Weight %
Iron	92 - 93
Carbon	3.4 - 3.9
Silicon	2.7 - 3.2
Manganese	0.25 Max
Phosphorus	0.06 Max
Sulphur	0.035 Max
Zinc*	0.05 - 0.35

\*For Galvanised product only.

NOTE: All commercial metals contain trace elements or residual elements, in addition to above specified.

## 2 - PHYSICAL & CHEMICAL CHARACTERISTICS

Melting Point: Base Metal 1510°C, Zinc Coating 420°C

Appearance & Odour: Metallic Gray, No Odour

## 3 - FIRE AND EXPLOSION DATA

Castings in solid state present no fire or explosion hazard.

## 4 - HEALTH HAZARD INFORMATION

Eyes: Metal particles in the eyes may cause irritation if not removed.

Breathing: Overexposure to dust or fumes from these castings may cause lung diseases.

First Aid: If in Eyes, Metal particle should be removed by a trained individual such as a nurse or physician. If breathed, move to fresh air.

## 5 - REACTIVITY DATA

Hazardous Polymerization: Will not occur. Stability: Stable

Incompatibility: Iron may cause violent decomposition of hydrogen peroxide (52% or more)

## 6 - SPILL OR LEAK PROCEDURES

If spilled, return castings to vendor or send to scrap recycler.

## 7 - SPECIAL PROTECTION INFORMATION

Respiratory: Approved dust and fume respirators should be used to avoid excessive inhalation of particulates

Skin: Protective gloves should be worn as required for welding, burning, or handling operations.

Eye: Use safety glasses or goggles for welding, burning, sawing, brazing, grinding, or machining operations.

Ventilation: Local exhaust ventilation should be provided when welding, burning sawing, brazing, grinding or machining to prevent excessive dust or fume exposure.

Other Protective Equipment: Depending on the conditions of use and specific work situations, additional protective equipment and/or clothing may be required.

## 8 - SPECIAL PRECAUTIONS

Storage: Keep dry to reduce rusting.

# Maintenance Instructions

## Safety

The importance of safe work operations cannot be avoided.

Every workers has to follow the safe work practices, hazard and risk identification has to be carried out prior to the maintenance and to be followed.

Work permit form safety to be obtained(if such system exist) prior to the maintenance.

Maintenance Checklist to be followed.

Proper and adequate PPEs to be used.

Use harness and Fall protection mechanism in case of working at height.

In an emergency situation the emergency action plan of the site to be followed.

## General

Physical Isolation or disconnection of supply to the live line to be carried out prior to removal of the fittings.

In case of wet riser the water should be drained.

Ensure that proper working tools with recommended torque are selected.

Unscrew the bolts evenly from the both sides of the Couplings/Mechanical Tee using the appropriate torque.

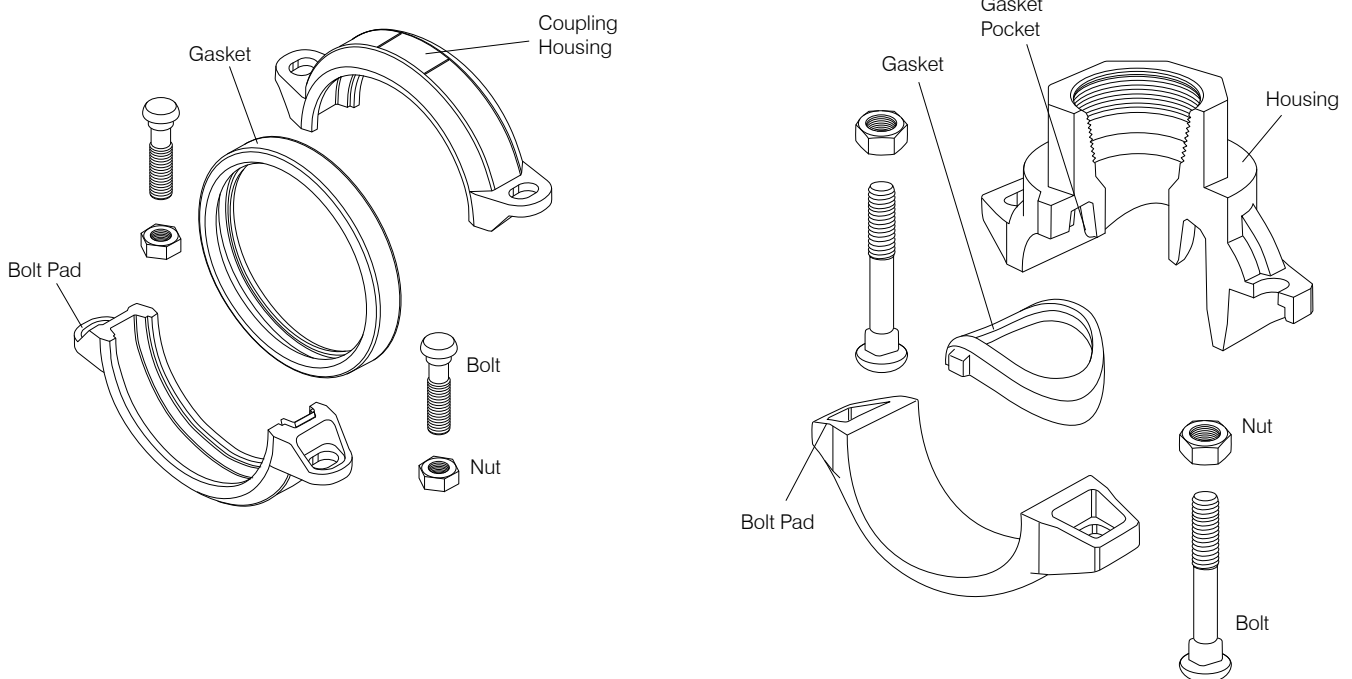
Remove the gasket from the pipes carefully.

Prevent the fall of the fittings while detaching from the pipe line by giving proper support.

Clean the fittings, gasket, nut & bolts to be free from the dust.

Store the fittings in a proper storage , do not keep it under direct sunlight or close to the hot surface.

While re-installation of the fittings the same installation instructions has to be strictly followed.



Note: Drawings are for illustration purpose only. Shield reserves the right to change the content without prior notice.



For further information on any aspect of the SHIELD range of Pipes & Fittings please contact your nearest office.

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