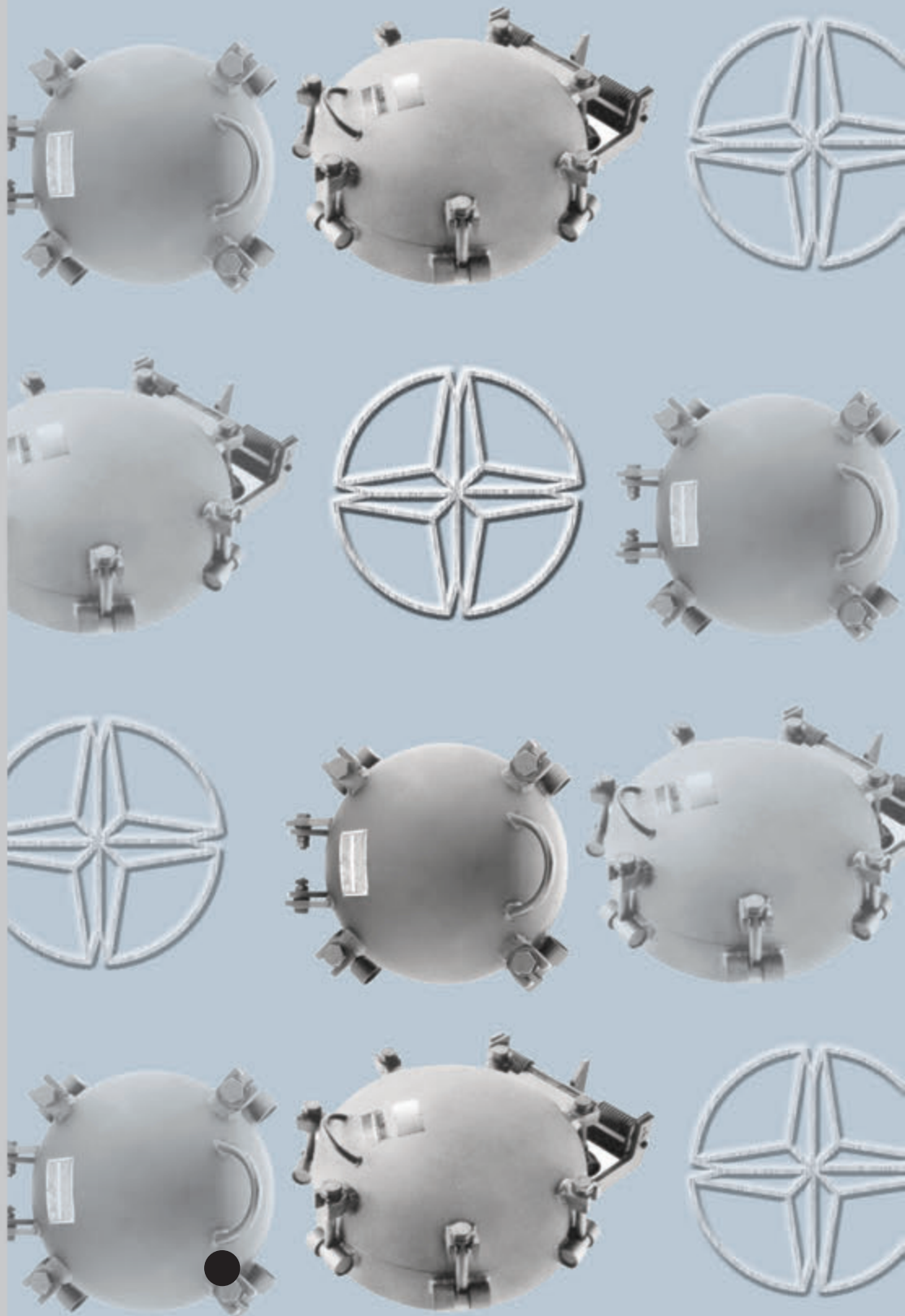


# T-BOLT STYLE CLOSURES



# T-BOLT HINGED CLOSURES

## GENERAL INFORMATION

Tube Turns' exclusive T-Bolt Closure is designed expressly for nominal pressure applications. Less expensive and much more satisfactory than blind flanges and job-fabricated closure devices, it is ideal for:

1. Manways for storage tanks, mixing vessels, filters, separators and other batch equipment.
2. Caps for inspection ports and other access openings on towers and reactors.
3. Handholes on processing equipment and medical or laboratory apparatus such as hyperbaric chambers.

## Economically Priced

Low initial cost is an especially attractive feature of the Tube Turns T-Bolt Closure. A complete unit normally costs less than the component parts for a blind and slip-on flange combination. There are no additional expenses for hinges, hoists, davits, etc., as the closure is fully assembled when shipped. Furthermore, installation and labor charges are held to a minimum; a single butt weld joins the closure to the nozzle vessel.

## Compact Design

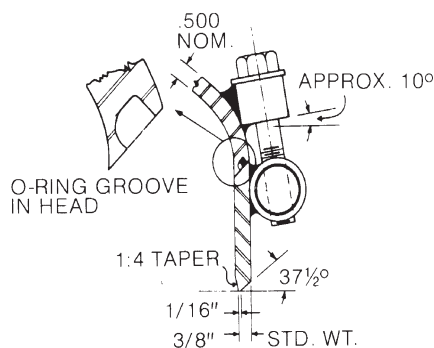
Simplicity of construction and operation are keynotes of the Tube Turns T-Bolt Hinged Closure. The closure consists of a thick semi-ellipsoidal head that is hinged to a matching hub, a self energized O-ring and a suitable number of T-Bolts to effect and maintain a tight seal. For most services, the standard materials—carbon steel and a "Buna-N" O-ring are satisfactory. Other metals and elastomers are furnished on special request.

The T-Bolt Hinged Closure is opened quickly and easily. The operator merely loosens the T-Bolts until they clear the head lugs and allow the head to be swung open on its hinge. Complete, unrestricted access is provided, too, since the standard hinging permits a full 180° opening.

## Warning Feature

The holding lugs are mounted on the closure head at an angle of approximately 10°. This provides a valuable feature, for the angular mounting requires that the T-bolt be backed off an extra turn or two before it will swing out of the holding position.

Thus, if there is pressure in the vessel while it is being opened, initial turns of the



bolts permit the head to lift slightly and the contained fluid escapes, alerting the operator to possible danger. Further movement of the head is restrained, since the T-bolt is confined within the holding lug.

## Operating Savings

Tube Turns T-Bolt Hinged Closures provide savings of time and labor. The semi-ellipsoidal shape of the T-Bolt Closure has greater pressure-holding capacity than a flat plate of equal thickness. This permits substantial weight reduction: the head of a 24" T-Bolt Closure, for instance, weighs only 100 pounds, as compared with 410 pounds for a comparable size 150 lb blind flange. *And the mechanical advantage afforded by the hinge arrangement further reduces the force needed to open a T-Bolt Closure.* Bolting is also simplified. A 24" T-Bolt Closure has but five bolts, while the same size 150 lb flange requires 20. Furthermore, the T-bolts remain attached to the closure when it is opened, eliminating possibilities of dropped or misplaced nuts, bolts and washers.

## Full Size Range

Standard Tube Turns T-Bolt Hinged Closures are furnished in carbon steel, stainless steel, & other alloys. Sizes range from 6" thru 66".

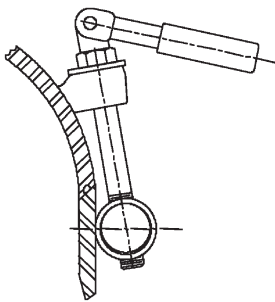


# T-BOLT

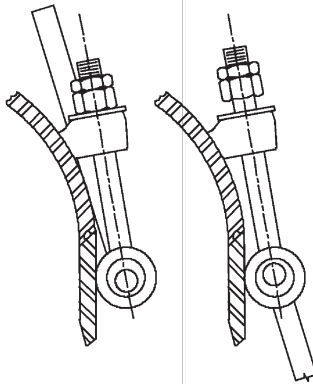
# HINGED CLOSURES

## T-BOLT CLOSURE OPTIONS

Break-Over Wrenches and Camlocks are optional attachments and accessories adding further to the versatility and utility of our T-Bolt Closures. Attachment of either of these options to the closure's T-Bolts provides extra convenience, speed and ease in tightening the bolts. These attachments eliminate the need for separate wrenches.



**Break-Over  
Wrench Assembly**



**Tightened Loosened  
Camlock Assembly**

The Break-Over Wrench Lug is welded to the T-Bolt (head bolt) and a handle is inserted over this lug. A pin is then inserted through the handle and the lug allowing the handle to act as a wrench and making the Break-Over Wrench an integral part of the T-Bolt Assembly.

In a Camlock Assembly, components replace the tapped swing nut (in the hub nut mount). The Camlock bolting unit consists of a high strength eye bolt that is pinned through an eccentric cam to provide the necessary clamping action. The coming action is adjustable by moving the adjustable nut at the threaded end of the eye bolt. This allows the camlock assembly to be loosened & tightened merely by lowering or raising the cam handle.



## Vertical T-Bolt Closures

T-Bolt Closures with a spring loaded head for vertical applications are furnished in sizes 10" - 42". The need for spring loading can be determined by reference to the table below. The tabulated "Force to Lift Head" is the force to lift the head **without** the springs.

Please note these handles may not be an option for certain sizes and/or orientations.

Closure Size	6	8	10	12	14	16	18	20	22	24	26	28	30	32	34	36	38	40	42
Weight of Head (lbs)	7	12	19	22	32	41	53	67	74	100	112	125	139	169	184	269	295	322	346
Force to Lift Head (lbs)	4	9	12	15	20	26	32	40	44	58	62	71	76	90	106	149	168	186	231

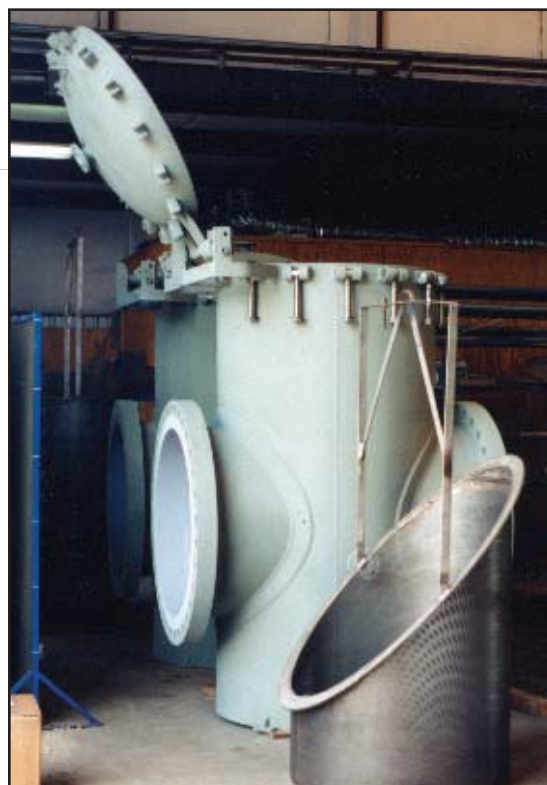
# T-BOLT RATINGS

\*Ratings are in PSI

Closure Size	Class 75		Class 150		Class 300	
	Carbon Steel	Stainless Steel**	Carbon Steel	Stainless Steel**	Carbon Steel	Stainless Steel**
6"	-	-	300	300	480	480
8"	-	-	175	175	370	370
10"	110	110	235	235	345	345
12"	165	165	245	245	370	370
14"	135	135	200	200	355	355
16"	105	105	180	180	375	375
18"	120	120	180	180	365	365
20"	95	95	170	170	345	345
22"	100	100	195	195	325	320
24"	115	105	185	185	305	305
26"	115	105	180	180	260	260
28"	110	100	190	190	250	250
30"	105	95	180	180	240	235
32"	100	90	175	160	205	190
34"	145	135	170	160	205	205
36"	120	110	165	160	180	180
38"	125	110	175	175	-	-
40"	105	95	170	170	-	-
42"	110	100	165	165	-	-
48"	120	120	135	135	-	-

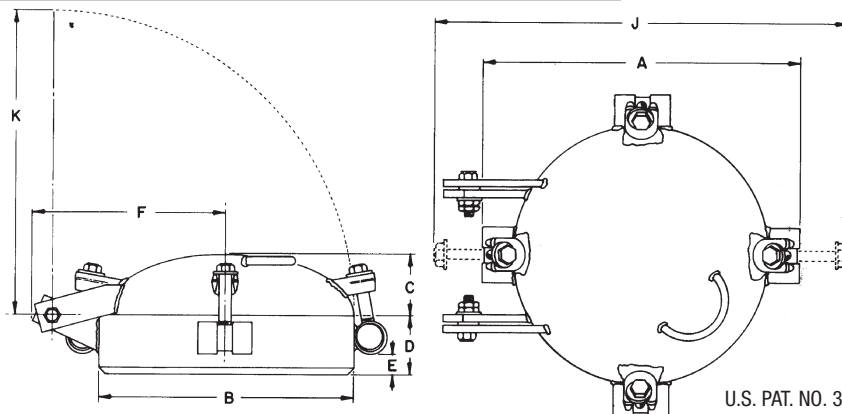
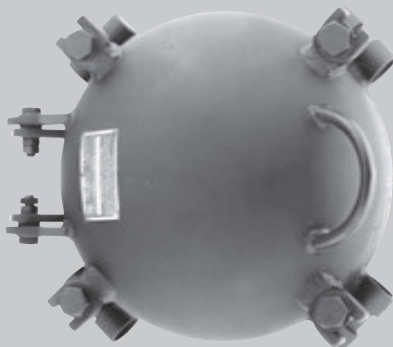
\*\* Ratings apply to stainless steel closures with carbon steel bolts and attachments. Closures of all stainless steel are rated lower. For temperatures higher than 450F, consult Tube Turns stating temperature, pressure, fluid and type of o-ring required. Ratings apply for closures with ASME SA325 bolts. Slightly higher ratings are available in some sizes upon application by using ASME SA193 Grade B7 bolts, resulting in a slightly higher price.

Above ratings good for 450F. "Buna-N" is the standard O-ring gasket material. For services above 250F or where special corrosive conditions are to be encountered, O-rings of "Viton", Silicone Rubber, "Neoprene", Ethylene Propylene, "Teflon Encapsulated" (Viton or Silicone Core) can be furnished at an extra charge. Refer to Page 7





# T-BOLT HORIZONTAL DIMENSIONS



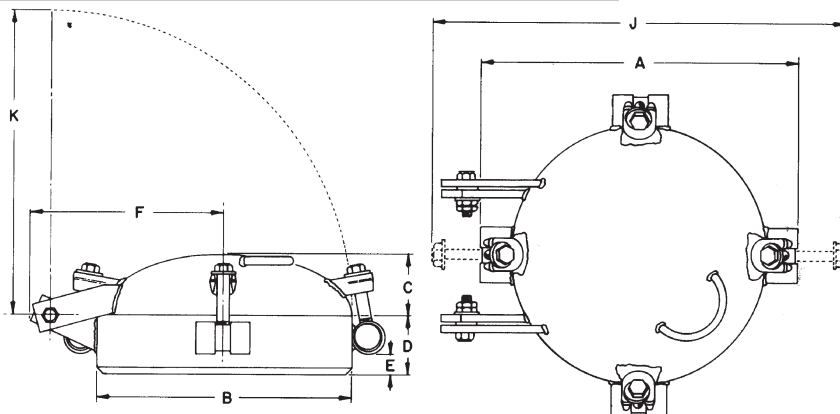
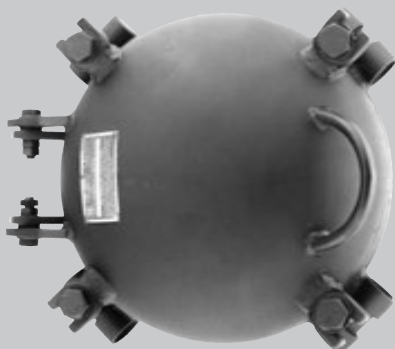
U.S. PAT. NO. 3,187,929

	Nom. Pipe Size	Nom.* Wall Thickness	Over-all A	OD at Welding Bevel B	Back to Face C	Hub Length D	Clear Hub Length E	Center to Hinge End F	Swing Bolt Clearance J	Opening Clearance K	No. Bolts	Bolt Size	Approx. Weight Lbs
<b>Class 75-TB T-Bolt Horizontal</b>	10	.500	13 3/8	10 3/4	2 13/16	2 1/2	1 1/16	7 5/8	18	12 1/4	3	1/2	30
	12	.500	16 1/8	12 3/4	3 1/8	2 5/8	3/4	8 15/16	21	14 1/4	4	5/8	50
	14	.500	17 3/8	14	3 9/16	2 7/8	1	9 9/16	22	15 1/2	4	5/8	60
	16	.500	19 3/8	16	4	2 7/8	1	10 1/2	24	17 1/2	4	5/8	70
	18	.500	21 3/8	18	4 1/2	3 3/8	1 3/8	11 11/16	30	19 1/2	4	3/4	95
	20	.500	23 3/8	20	4 15/16	3 7/8	1 7/8	12 15/16	32	21 11/16	4	3/4	115
	22	.500	25 3/8	22	5 1/4	4 3/8	2 3/8	13 15/16	34	23 11/16	5	3/4	140
	24	.500	27 7/8	24	5 3/4	4 3/8	1 13/16	15	38	25 11/16	5	7/8	165
	26	.500	29 7/8	26	6 1/4	4 3/8	1 13/16	16 1/4	40	28	6	7/8	180
	28	.500	31 7/8	28	6 3/4	4 3/8	2 1/8	17 1/4	42	30	7	7/8	200
	30	.500	33 7/8	30	7 1/4	4 3/8	1 7/8	18 5/16	45	32	8	7/8	230
	32	.500	35 7/8	32	7 3/4	4 3/8	2	19 5/8	47	34	9	7/8	265
	34	.625	38 3/4	34	8 3/16	4 3/8	1 5/16	20 5/8	51	36	9	1 1/8	325
	36	.625	40 3/4	36	8 11/16	4 1/2	1 5/8	21 9/16	53	38	9	1 1/8	410
	38	.625	42 3/4	38	9 3/16	4 1/2	1 5/8	22 9/16	55	40	10	1 1/8	450
	40	.625	44 3/4	40	9 11/16	4 1/2	1 5/8	22 3/4	57	42	10	1 1/8	480
<b>Class 150-TB T-Bolt Horizontal</b>	42	.625	46 3/4	42	10 3/16	4 1/2	1 5/8	25 5/16	61	44 3/4	11	1 1/8	550
	48	.750	52 3/4	48	11 3/4	7	4 1/8	28 1/8	67	49 1/2	14	1 1/8	830
	6	.500	9 1/4	6 5/8	2 1/8	1 11/16	1/4	5 1/2	13	8	3	1/2	15
	8	.500	11 1/4	8 5/8	2 3/16	2 1/4	13/16	6 5/8	15	10 1/8	3	1/2	20
	10	.500	14 1/8	10 3/4	2 13/16	2 1/2	3/4	7 5/8	19	12 1/4	4	5/8	35
	12	.500	16 1/8	12 3/4	3 1/8	2 5/8	3/4	9	23	14 5/16	4	3/4	55
	14	.500	17 3/8	14	3 9/16	2 7/8	1	9 9/16	24	15 1/2	4	3/4	65
	16	.500	19 3/8	16	4	2 7/8	1	10 1/2	26	17 1/2	7	5/8	80
	18	.500	21 3/8	18	4 1/2	3 3/8	1 3/8	11 11/16	30	19 1/2	6	3/4	100
	20	.500	23 3/8	20	4 15/16	3 7/8	1 7/8	12 15/16	32	21 11/16	7	3/4	125
	22	.500	25 3/4	22	5 1/4	4 3/8	1 13/16	15 1/2	36	23 3/16	7	7/8	150
	24	.500	27 7/8	24	5 3/4	4 3/8	1 7/8	15	38	25 11/16	8	7/8	180
	26	.500	29 7/8	26	6 1/4	4 3/8	1 13/16	16 1/4	40	28	9	7/8	200
	28	.500	31 7/8	28	6 3/4	4 3/8	2 1/8	17 1/4	43	30	11	7/8	225
	30	.500	33 7/8	30	7 1/4	4 3/8	1 7/8	18 5/16	45	32	12	7/8	250
	32	.500	36 3/4	32	7 3/4	4 3/8	1 5/16	19 5/8	49	34	10	1 1/8	310
	34	.625	38 3/4	34	8 3/16	4 3/8	1 5/16	20 5/8	53	36	10	1 1/8	380
	36	.625	40 3/4	36	8 11/16	4 1/2	1 5/8	21 9/16	55	38	11	1 1/8	460
	38	.625	42 3/4	38	9 3/16	4 1/2	1 5/8	22 9/16	59	40 1/16	13	1 1/8	500
	40	.625	44 3/4	40	9 11/16	4 1/2	1 5/8	26 1/16	57	44 7/16	14	1 1/8	550
	42	.625	46 3/4	42	10 3/16	4 1/2	1 5/8	25	61	44 7/16	15	1 1/8	600
	48	.750	52 3/4	48	11 3/4	7	4 1/8	28	67	52	16	1 1/8	860

All dimension are in inches. When ordering, please specify class, nominal size, bore, material and service conditions. T-Bolt Closures with longer hubs; Closures made to I.D. dimensions; or Closures equipped with Sight Glasses, Break-over Wrenches, Camlocks and other accessories are available on special order. \*Standard Closures are taper bored to match standard wall thickness.



# T-BOLT HORIZONTAL DIMENSIONS



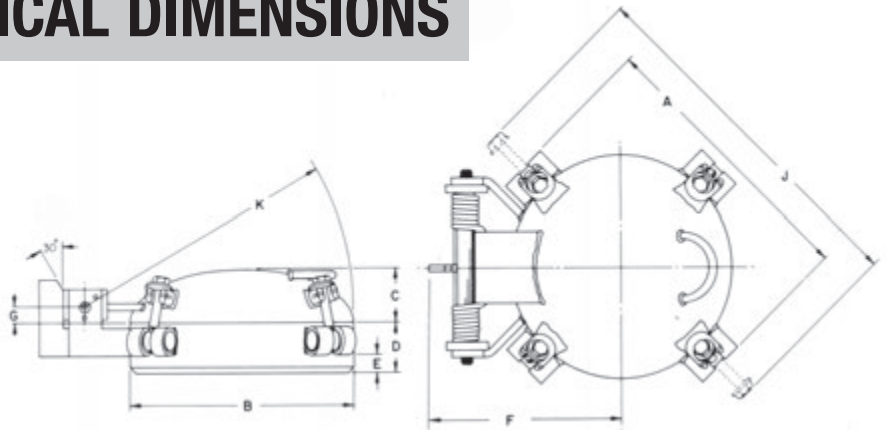
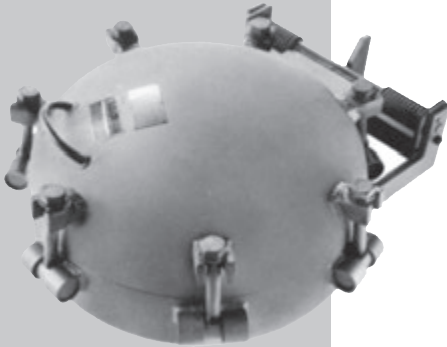
	Nom. Pipe Size	Nom.* Wall Thickness	Over-all A	OD at Welding Bevel B	Back to Face C	Hub Length D	Clear Hub Length E	Center to Hinge End F	Swing Bolt Clearance J	Opening Clearance K	No. Bolts	Bolt Size	Approx. Weight Lbs
<b>Class 300-TB T-Bolt Horizontal</b>	6	.500	9 7/8	6 5/8	2 1/8	2 1/16	5/16	5 5/8	16	8 1/8	3	5/8	18
	8	.500	11 7/8	8 5/8	2 3/16	2 1/4	7/16	6 9/16	19	10 1/8	4	5/8	27
	10	.500	14 1/8	10 3/4	2 13/16	2 1/2	5/8	7 5/8	20	12 1/4	4	3/4	35
	12	.500	16 1/8	12 3/4	3 1/8	2 5/8	3/4	9 3/4	23	15 3/16	6	3/4	55
	14	.500	17 3/8	14	3 9/16	2 7/8	1	9 1/2	25	15 7/8	7	3/4	70
	16	.500	19 7/8	16	4	2 7/8	3/8	10 1/8	29	17 1/2	7	7/8	85
	18	.500	22 3/4	18	4 1/2	3 3/8	5/8	11 3/4	33	20	6	1 1/8	130
	20	.500	24 3/4	20	4 15/16	3 7/8	1 1/8	12 5/16	36	21 9/16	7	1 1/8	175
	22	.500	26 3/4	22	5 1/4	4 3/8	1 5/8	13 15/16	38	23 11/16	8	1 1/8	200
	24	.500	28 3/4	24	5 3/4	4 3/8	1 5/8	16	40	26 11/16	9	1 1/8	230
	26	.500	30 3/4	26	6 1/4	4 3/8	1 1/4	16 5/8	42	28 5/8	9	1 1/8	250
	28	.500	32 3/4	28	6 3/4	4 3/8	1 5/8	17 5/16	45	30	10	1 1/8	275
	30	.500	34 3/4	30	7 1/4	4 3/8	1 11/16	18 5/16	47	32	11	1 1/8	300
	32	.500	36 3/4	32	7 3/4	4 3/8	1 5/16	19 11/16	49	34 7/16	11	1 1/8	360
	34	.625	38 3/4	34	8 3/16	4 3/8	1 5/16	21 1/8	53	36 1/2	12	1 1/8	440
	36	.625	40 3/4	36	8 11/16	4 1/2	1 5/8	25 5/16	55	38 3/4	12	1 1/8	510

All dimension are in inches. When ordering, please specify class, nominal size, bore, material and service conditions. T-Bolt Closures with longer hubs; Closures made to I.D. dimensions; or Closures equipped with Sight Glasses, Break-over Wrenches, Camlocks and other accessories are a vailable on special order. \*Standard Closures are taper bored to match standard wall thickness.



We stock T-Bolt Closures in many sizes, pressure classes and materials.

# T-BOLT VERTICAL DIMENSIONS



	Nom. Pipe Size	Nom.* Wall Thickness	Over-all A	OD at Welding Bevel B	Back to Face C	Hub Length D	Clear Hub Length E	Center to Hinge End F	Face to Hinge G	Swing Bolt Clearance H	Opening Clearance I	No. Bolts J	Bolt Size K	Approx. Weight Lbs
<b>Class 75-TBV T-Bolt Vertical</b>	10	.500	13 3/8	10 3/4	2 13/16	2 1/2	1 1/16	8 1/4	1 3/8	18	1 11/16	3	1/2	35
	12	.500	16 1/8	12 3/4	3 1/8	2 5/8	3/4	9 7/8	1 1/2	21	13 15/16	4	5/8	55
	14	.500	17 3/8	14	3 9/16	2 7/8	1	10 1/4	1 1/2	22	15 1/16	4	5/8	65
	16	.500	19 3/8	16	4	2 7/8	1	11 1/4	1 1/2	24	17 1/16	4	5/8	75
	18	.500	21 3/8	18	4 1/2	3 3/8	1 3/8	13 5/8	1 7/16	30	20 1/16	4	3/4	105
	20	.500	23 3/8	20	4 15/16	3 7/8	1 7/8	14 3/4	1 11/16	32	22 1/16	4	3/4	130
	22	.500	25 3/8	22	5 1/4	4 3/8	2 3/8	17 1/4	2 1/4	34	25 9/16	5	3/4	160
	24	.500	27 7/8	24	5 3/4	4 3/8	1 13/16	19 3/8	1 3/4	38	28 5/16	5	7/8	190
	26	.500	29 7/8	26	6 1/4	4 3/8	1 13/16	21 1/4	1 7/8	40	31 1/4	6	7/8	200
	28	.500	31 7/8	28	6 3/4	4 3/8	2 1/8	23	2 1/8	42	33 13/16	7	7/8	225
	30	.500	33 7/8	30	7 1/4	4 3/8	1 7/8	23	1 7/8	45	35 1/16	8	7/8	260
	32	.500	35 7/8	32	7 3/4	4 3/8	2	23	2	47	36 1/16	9	7/8	295
	34	.625	38 3/4	34	8 3/16	4 3/8	1 5/16	25 1/4	2 5/16	51	38 9/16	9	1 1/8	365
	36	.625	40 3/4	36	8 11/16	4 1/2	1 5/8	27	2 1/2	53	41 1/16	9	1 1/8	480
	38	.625	42 3/4	38	9 3/16	4 1/2	1 5/8	28	2 1/2	55	43 1/16	10	1 1/8	515
	40	.625	44 3/4	40	9 11/16	4 1/2	1 5/8	28 13/16	2 7/8	57	45 1/16	10	1 1/8	550
	42	.625	46 3/4	42	10 3/16	4 1/2	1 5/8	30 7/16	2 7/8	61	47 1/16	11	1 1/8	630
<b>Class 150-TBV T-Bolt Vertical</b>	10	.500	14 1/8	10 3/4	2 13/16	2 1/2	3/4	9 7/8	1 1/8	19	13 1/2	4	5/8	35
	12	.500	16 1/8	12 3/4	3 1/8	2 5/8	3/4	10 7/8	1 1/2	23	14 7/8	4	3/4	60
	14	.500	17 3/8	14	3 9/16	2 7/8	1	10 1/4	1 1/2	24	15	4	3/4	70
	16	.500	19 3/8	16	4	2 7/8	1	13 13/16	1 1/2	26	19 3/16	7	5/8	85
	18	.500	21 3/8	18	4 1/2	3 3/8	1 3/8	14 3/8	1 5/8	30	20 1/2	6	3/4	110
	20	.500	23 3/8	20	4 15/16	3 7/8	1 7/8	15 7/8	1 1/8	32	22 1/2	7	3/4	140
	22	.500	25 3/4	22	5 1/4	4 3/8	1 13/16	19 3/8	1 1/4*	36	25 1/2	7	7/8	170
	24	.500	27 7/8	24	5 3/4	4 3/8	1 7/8	19 3/8	2	38	28 1/4	8	7/8	205
	26	.500	29 7/8	26	6 1/4	4 3/8	1 13/16	22 1/4	2 1/8	40	31 5/8	9	7/8	225
	28	.500	31 7/8	28	6 3/4	4 3/8	2 1/8	23	2 1/8	43	33 3/4	11	7/8	250
	30	.500	33 7/8	30	7 1/4	4 3/8	1 7/8	27	1 3/8*	45	35	12	7/8	280
	32	.500	36 3/4	32	7 3/4	4 3/8	1 5/16	25	2	49	37	10	1 1/8	340
<b>Class 300-TBV T-Bolt Vertical</b>	34	.625	38 3/4	34	8 3/16	4 3/8	1 5/16	27 7/8	1 3/4*	53	38 1/2	10	1 1/8	420
	36	.625	40 3/4	36	8 11/16	4 1/2	1 5/8	29 1/2	1 3/4*	55	41	11	1 1/8	530
	10	.500	14 1/8	10 3/4	2 13/16	2 1/2	5/8	9 7/8	1 1/8	20	13 1/2	4	3/4	40
	12	.500	16 1/8	12 3/4	3 1/8	2 5/8	3/4	12 5/8	1 3/8	23	16 3/8	6	3/4	65
	14	.500	17 3/8	14	3 9/16	2 7/8	1	12 3/8	1 1/2	25	17 1/4	7	3/4	75
	16	.500	19 7/8	16	4	2 7/8	3/8	13 7/8	1 1/2	29	19 1/2	7	7/8	90
	18	.500	22 3/4	18	4 1/2	3 3/8	5/8	16 3/4	1	33	23	6	1 1/8	120
	20	.500	24 3/4	20	4 15/16	3 7/8	1 1/8	18 5/8	1 1/2	36	26	7	1 1/8	145
	22	.500	26 3/4	22	5 1/4	4 3/8	1 5/8	20	2 3/8	38	27 5/8	8	1 1/8	180
	24	.500	28 3/4	24	5 3/4	4 3/8	1 5/8	20 1/4	1 7/8	40	28 7/8	9	1 1/8	210
	26	.500	30 3/4	26	6 1/4	4 3/8	1 1/4	20 3/4	2 1/8	42	31 1/2	9	1 1/8	230
	28	.500	32 3/4	28	6 3/4	4 3/8	1 5/8	22 3/4	2 1/8	45	33 3/4	10	1 1/8	260
	30	.500	34 3/4	30	7 1/4	4 3/8	1 11/16	23 5/8	1 3/8	47	35 1/4	11	1 1/8	290
	32	.500	36 3/4	32	7 3/4	4 3/8	1 5/16	25	1 5/8	49	37 1/4	11	1 1/8	350
	34	.625	38 3/4	34	8 3/16	4 3/8	1 5/16	26 1/2	1 1/2	53	39 1/2	12	1 1/8	435
	36	.625	40 3/4	36	8 11/16	4 1/2	1 5/8	27 1/2	2 1/8	55	41 1/2	12	1 1/8	540

All dimension are in inches. When ordering, please specify class, nominal size, bore, material and service conditions. T-Bolt Closures with longer hubs; Closures made to I.D. dimensions; or Closures equipped with Sight Glasses, Break-over Wrenches, Camlocks and other accessories are available on special order. \*Standard Closures are taper bored to match standard wall thickness.



# T-BOLT

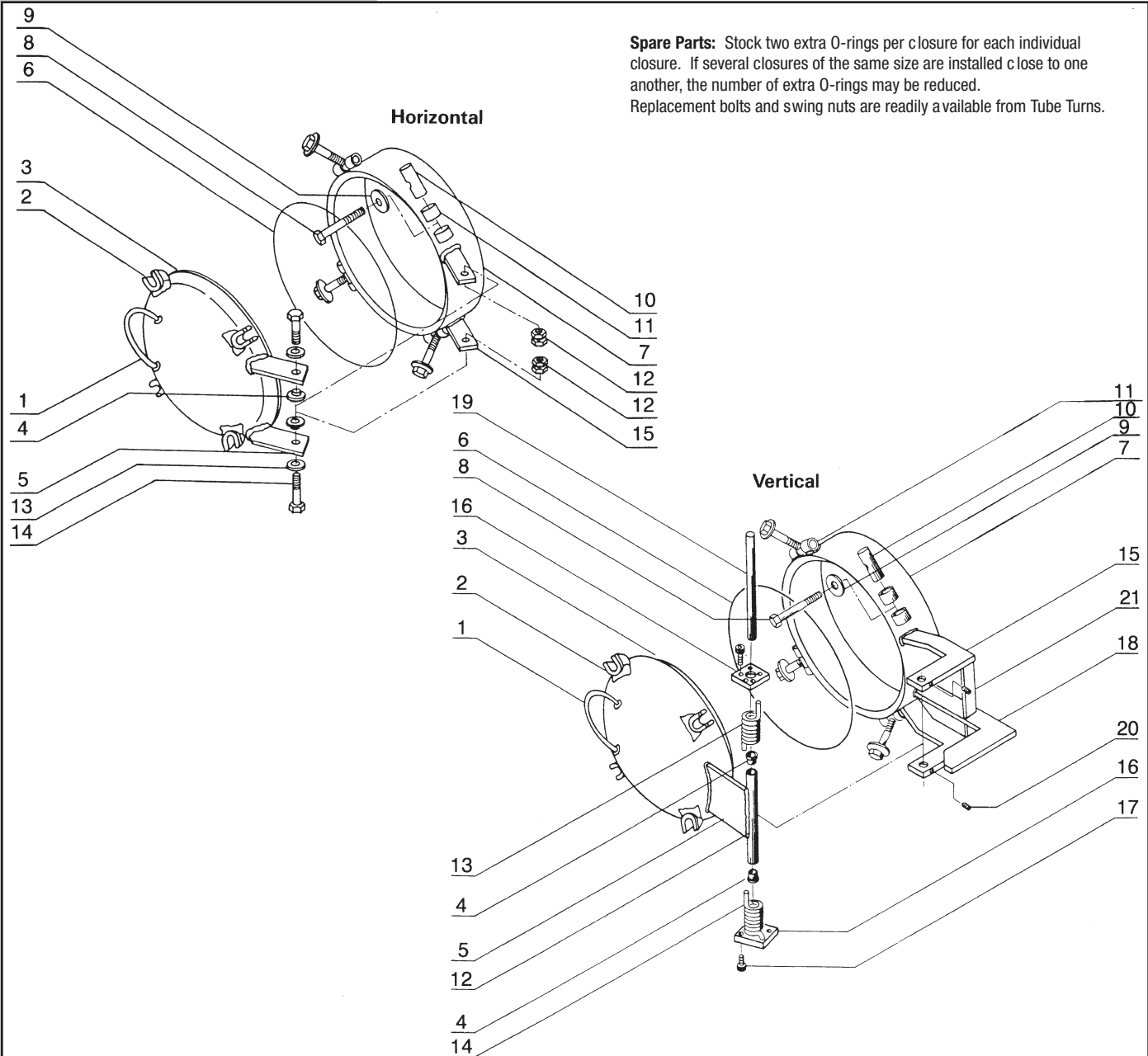
# CLOSURE PARTS

## T-Bolt Closure Horizontal Parts List

1. Head Handle	4. Hinge Bushings	7. Hub	10. Tapped Swing Nut	13. Hinge Bolt Washer
2. Head Bolt Lug	5. Head Hinge Arm	8. Head Bolt	11. Hub Nut Mounts	14. Hinge Bolt
3. Head	6. O-Ring	9. Head Bolt Washer	12. Hinge Bolt Nut	15. Hub Hinge Arms

## T-Bolt Closure Vertical Parts List

1. Head Handle	6. O-ring	11. Hub Nut Mounts	16. Adjusting Plate	21. Hinge Brace
2. Head Bolt Lug	7. Hub	12. Hinge Tube	17. Lock Screw	
3. Head	8. Head Bolt	13. Spring (R.H.)	18. Head Stop	
4. Hinge Bushing	9. Head Bolt Washer	14. Spring (L.H.)	19. Hinge Rod	
5. Head Hinge Arm	10. Tapped Swing Nut	15. Hub Hinge Arms	20. Hinge Rod Set Screw	





# TERMS AND CONDITIONS

1. Seller's quotation, bid or other communication to Buyer of proposed prices for Seller's products or services shall constitute an offer which may only be rejected, or accepted on the condition that Buyer assents to the terms contained herein. Buyer's acceptance hereof, is limited and restricted to these terms. Seller objects to and refuses to be bound by any terms additional to or different from those contained herein. Buyer's issuance of a purchase order, oral acceptance, partial payment or any other action consistent with acceptance shall be deemed acceptance of Seller's offer.

2. Prices are subject to change without notice, and all orders are to be invoiced at Seller's prices prevailing when shipped or provided.

3. Any taxes which Seller may be required to pay or collect with respect to the sale, purchase, delivery, transportation, storage, processing, use, or consumption of any of the products or services covered hereby, shall be for the account of Buyer, who shall promptly pay the amount thereof to Seller upon demand.

4. All accounts are payable in United States funds, free of exchange, collection or other charges. If Buyer fails to fulfill the terms of payment or if Seller shall have any doubt at any time as to Buyer's financial responsibility, Seller may suspend production or service and/or decline to make shipment, delivery or service except upon receipt of cash or security satisfactory to Seller.

5. Unless otherwise specifically provided herein, delivery will be made f.o.b. point of shipment, all risk of loss shall pass to Buyer upon delivery to carrier, and Buyer shall be responsible for obtaining insurance if desired. The method and agency of transportation and the routing, unless specified on the face hereof, will be selected by Seller, and Seller reserves the right to ship freight collect. Shipping and other performance dates are approximate and are based on prompt receipt of all necessary information.

6. Seller shall not be liable for any delay in performance due to fire, explosion, casualty, strike or other labor difficulties, shortages of material, utility, facility or labor, delay in transportation, breakdown or accident, or any cause whether similar or dissimilar beyond Seller's reasonable control, and Seller shall have such additional time for performance as may be reasonably necessary under the circumstances and the right to apportion its production among its customers in any manner it sees fit.

7. Any claims for shortages, damaged products or damage due to services, or nonconformance of products or services with the order must be made in writing within ten (10) days after receipt, and Seller must be afforded an opportunity to investigate.

8. Cancellation or alteration of an order or return of any product by Buyer may not be made without advance written consent by Seller and, at Seller's option, shall be subject to a cancellation, alteration or return charge acceptable to Seller.

9. Seller warrants that its products or services are free from defects in material and workmanship.

10. IN THE EVENT OF BREACH OF ANY WARRANTY OR OTHER OBLIGATION ARISING HEREUNDER, SELLER'S SOLE AND EXCLUSIVE LIABILITY SHALL BE AT ITS SOLE OPTION TO REPAIR, REPLACE, F.O.B. POINT OF SHIPMENT, ANY DEFECTIVE PRODUCT, OR TO REFUND THE PURCHASE PRICE IN EXCHANGE FOR THE RETURN, TRANSPORTATION PREPAID, OF ANY SUCH PRODUCT OR IN THE CASE OF SERVICES, TO REFUND OR WAIVE ANY UNPAID SERVICE FEE; in any case provided that such product or service within 12 months from date of shipment or provision to Buyer is found by Seller to have been defective at the time of such shipment or service, that the product or service has been installed, operated or utilized in accordance with generally

approved practice and in accordance with Seller's instructions, that no repairs, alterations or replacements have been made by others without Seller's written approval, and that Buyer notifies Seller in writing within 10 days after the defect becomes apparent and promptly furnishes full particulars in connection therewith; and PROVIDED FURTHER THAT IN NO EVENT SHALL THE AGGREGATE LIABILITY OF SELLER IN CONNECTION WITH BREACH OF ANY WARRANTY OR WARRANTIES EXCEED THE PURCHASE PRICE PAID FOR THE PRODUCTS OR SERVICES PURCHASED HEREUNDER. Seller, may, at its option, require the return of any product, transportation and duties prepaid, to establish any claim of defect made by Buyer. EXCEPT AS EXPRESSLY STATED IN THIS INSTRUMENT, SELLER MAKES NO WARRANTIES EXPRESS OR IMPLIED, AND DOES NOT WARRANT THAT THE PRODUCTS OR SERVICES SOLD HEREUNDER ARE MERCHANTABLE OR FIT FOR ANY PARTICULAR PURPOSE.

11. Seller will defend at its own expense any suit or legal proceeding instituted against Buyer, and will pay any damages and costs awarded therein against Buyer, insofar as the same are based on a claim that any product furnished hereunder, except as excluded below, in itself constitutes an infringement of any United States patent, provided Buyer gives Seller prompt written notice of such infringement claim and of the institution of such suit or proceeding and also gives Seller all necessary authority, information and reasonable assistance to enable Seller, at Seller's option, to settle or defend the same. In case any said product is held in such suit to constitute an infringement and its use is enjoined, Seller at its own expense will either procure for Buyer the right to continue using said product, or modify same so that it becomes non-infringing, or replace it with a non-infringing product, or remove the product and refund the purchase price paid therefor by Buyer. The foregoing provisions state Seller's entire obligation and liability for patent infringement; and it is understood and agreed that there shall be excluded from the operation of said provisions any and all products or services provided in accordance with particular designs, specifications or instructions expressly or impliedly prescribed by Buyer, and Buyer will indemnify and hold harmless Seller from and against all loss, cost, expense, damage and liability of any nature or kind (including attorney's fees, advanced as incurred) for or on account of any patented or unpatented invention or trade secret in compliance with any such designs, specifications or instructions.

12. The Buyer and Seller agree that if either party brings a future lawsuit or other litigation against the other for any reason, the prevailing party shall recover its reasonable attorneys' fees, court costs, expert witness fees, and other reasonable expenses in connection with such litigation. The Buyer and the Seller further agree that in any subsequent litigation, the term "costs incurred" in Federal Rule of Civil Procedure 68(d), or any substantially similar state rule or for the purposes of any arbitration, shall include reasonable attorneys' fees as between the parties. By way of limited example, if Buyer were to bring a patent infringement lawsuit against Seller seeking damages and injunctive relief, and prior to the trial Seller were to offer judgment under FRCP 68 permitting a judgment of injunctive relief and an award of \$100 in damages which offer Buyer did not accept within the time allotted by the rule, and subsequently Buyer were to obtain the injunctive relief but recover less than \$100 in damages, then Seller would be considered the "prevailing party" for those fees and costs incurred after the offer had expired and Buyer would be considered the "prevailing party" for those fees and costs incurred prior to the expiration of the offer.

13. SELLER SHALL NOT, EXCEPT AS SET FORTH ABOVE, BE OTHERWISE LIABLE TO BUYER OR TO ANY PERSON WHO SHALL PURCHASE FROM BUYER, OR USE, ANY PRODUCTS OR SERVICES SUPPLIED HEREUNDER FOR DAMAGES OF ANY KIND, INCLUDING, BUT NOT LIMITED TO, DIRECT, INDIRECT, SPECIAL OR CONSEQUENTIAL DAMAGES OR LOSS OF PRODUCTION OR LOSS OF PROFITS RESULTING FROM ANY CAUSE WHATSOEVER, INCLUDING, BUT NOT LIMITED TO, ANY DELAY, ACT, ERROR OR OMISSION OF SELLER. This offer to purchase will be governed exclusively by the internal laws, and in the courts, of Kentucky, including the Uniform Commercial Code (subject to Buyer's right to elect arbitration, under rules reasonably specified by Buyer), for all or any portion of any disputes hereunder. In any dispute arising hereunder, Seller shall reimburse Buyer's attorneys' fees and expenses, as incurred.

14. Technical information, recommendations and advice as to properties and usages of materials, design, installation and use of products or services, engineering and other matters are provided as an accommodation and are intended only as suggestions. Although believed to be accurate, SELLER ASSUMES NO OBLIGATION OR LIABILITY FOR ANY RESULTS OBTAINED IN THEIR USE OR APPLICATION, AND THEY ARE NOT TO BE CONSTRUED AS ESTABLISHING ANY WARRANTY, EXPRESS OR IMPLIED.

15. Buyer shall ensure that its employees, officers, directors, managers, partners, owners, representatives and agents ("Buyer Parties") fully comply with all the provisions of the U.S. Foreign Corrupt Practices Act of 1977, as amended. Buyer, and Buyer Parties, are strictly forbidden from offering or providing any direct or indirect payments, gifts or other consideration and/or extending any favors to any government officials or officers, managers in any national or privately held companies, political party candidates, or any relatives, spouses or other family members of the foregoing, in exchange for favorable treatment or promotion of the Seller's products or services, terms of service or sale, or enforcement of the Seller's rights or obligations.

16. Buyer agrees, with respect to the exportation or resale of the products or services, and or parts thereof by Buyer, to comply with all the requirements of the International Traffic in Arms Regulations (ITAR) and the Export Administration Regulations (EAR), regulations issued thereunder and any subsequent amendments thereto, and all other national and United States Government export control laws and regulations on export controls. Export Controls include, but are not limited to, laws and regulations pertaining to export licenses, restrictions on export to embargoed countries and restrictions on sales to certain persons and or entities. Buyer shall immediately notify Seller if it is or becomes listed on any Excluded or Denied Party List of any agency or the U.S. Government or its export privileges are denied, suspended or revoked.

17. This agreement shall inure to the benefit of and be binding upon the successors and assigns of the parties hereto.

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