

TUBE WORKS MANDREL & WIPER REFERENCE CHART

MILD STEEL		D OF BEND = D.O.B. = RATIO OF THE CENTERLINE RADIUS TO THE TUBE DIAMETER											
		<small>(DOB = CENTERLINE RADIUS / TUBE DIAMETER)</small>											
		1	1.5	2	2.5	3	3.5	4	4.5	5	5.5	6	
WALL FACTOR	<small>(WF = TUBE DIAMETER / WALL THICKNESS)</small>	10	Plug	Plug	Plug	Plug	Plug	Plug	None	None	None	None	None
	20	S1	S1	S1	S1	S1	S1	Plug	Plug	Plug	None	None	
	30	S2	S2	S2	S1	S1	S1	S1	S1	Plug	Plug	Plug	
	40	S3	S3	S3	S2	S2	S2	S2	S2	S1	S1	Plug	
	50	C4	C3	S3	S3	S3	S3	S3	S3	S3	S2	S2	
	60	C4	C4	C3	C3	S3	S3	S3	S3	S3	S2	S2	
	70	C5	C5	C4	C4	C3	S3	S3	S3	S3	S3	S3	
	80	C5	C5	C4	C4	C4	C4	C4	C4	C4	C4	S3	S3
	90	C6	C5	C4	C4	C4	C4	C4	C4	C4	C4	C4	C4
	100	C6	C5	C5	C5	C5	C5	C5	C5	C5	C5	C4	C4
	125	C6	C6	C5	C5	C5	C5	C5	C5	C5	C5	C4	C4
	150	U7	C6	C6	C6	C6	C6	C5	C5	C5	C5	C5	C5

Wiper is recommended		
S = Standard Pitch Balls	C = Closed Pitch Balls	U = Ultra Pitch Balls
Recommendations are based on 90 degree bends. For 180 degree bends add one ball.		
For 4" thru 6" Tube Diameters & 16ga to 18ga wall & less than a 2D bend, we recommend using TWI UC-M Pitch Mandrel Balls & Links		
For tube diameters exceeding 1" and for material other than steel, we recommend the addition of 1 more ball and a closed pitch		
Use hardened steel mandrels & balls with coatings for steel, aluminized steel, copper and aluminum tube.		
Use aluminized bronze for stainless steel and other alloys.		