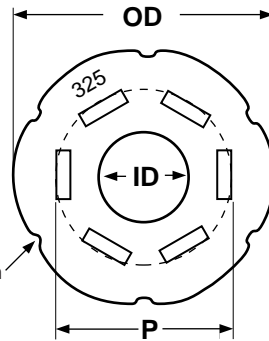
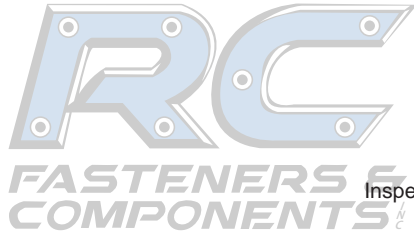


For Use with  
Structural Fasteners

# Tension Indicating

Washers

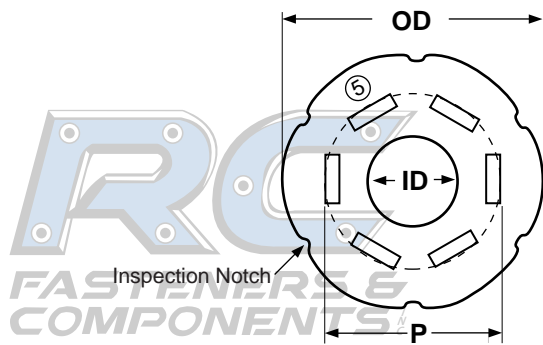


FASTENERS & COMPONENTS

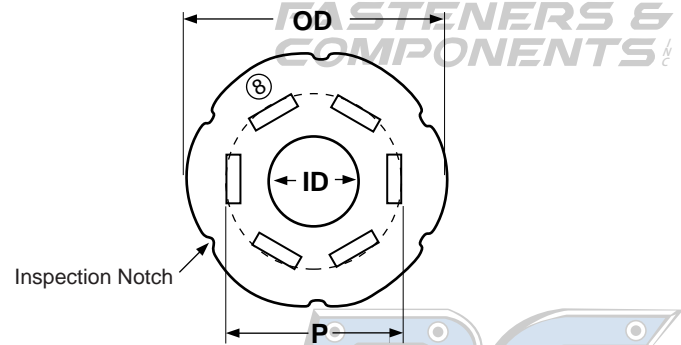


ASTM F959 DIRECT TENSION INDICATOR WASHERS - USED W/TYPE 325 STRUCTURAL FASTENERS										ASTM F959	
Nominal Size	OD		ID		TH		P	Number of Protrusions (equally spaced)	Compression Load Range (lbs.)		
	Outside Diameter		Inside Diameter		Thickness				Protrusion Tangential Diameter	Max	Min
	Max	Min	Max	Min	With Protrusion Max	Without Protrusion Min	Max				
1/2	1.187	1.167	0.527	0.523	0.180	0.104	0.788	4	14,000	12,000	
5/8	1.375	1.355	0.658	0.654	0.220	0.126	0.956	4	23,000	19,000	
3/4	1.625	1.605	0.790	0.786	0.230	0.126	1.125	5	34,000	28,000	
7/8	1.875	1.855	0.921	0.917	0.240	0.142	1.294	5	47,000	39,000	
1	2.000	1.980	1.052	1.048	0.270	0.158	1.463	6	61,000	51,000	
1 1/8	2.250	2.230	1.183	1.179	0.270	0.158	1.631	6	67,000	56,000	
1 1/4	2.500	2.480	1.315	1.311	0.270	0.158	1.800	7	85,000	71,000	
1 3/8	2.750	2.730	1.446	1.442	0.270	0.158	1.969	7	102,000	85,000	
1 1/2	3.000	2.980	1.577	1.573	0.270	0.158	2.138	8	124,000	103,000	

<b>Description</b>	A round washer with notches formed into its outer edge, protrusions equally spaced from each other on the top face and corresponding pockets on the bottom face.
<b>Applications/ Advantages</b>	These washers are designed to be used with A325 structural bolts. The washer is placed beneath the head of the bolt and as the bolt is tightened, the protrusions compress. When the protrusions have been flattened a sufficient amount the fastening has achieved the proper tension. Direct tension indicators are not affected by the presence of oil or other lubricants, and they measure tension regardless of surface condition. They help ensure proper tension is achieved even when a simple box wrench or socket wrench are the only tools that can be used to tighten the screw.
<b>Material</b>	Direct tension indicator washers shall be manufactured from a steel which conforms to the following chemical composition requirements (product analysis): Carbon- 0.27-0.53%; Manganese- 0.47-0.93%; Phosphorous- 0.043% maximum; Sulfur- 0.048% maximum; Silicon- 0.13-0.37%
<b>Heat Treatment</b>	Parts shall be through hardened by heating to a temperature above the upper transformation temperature, quenched in liquid, then tempered by reheating to a suitable temperature to achieve the listed mechanical and performance requirements.
<b>Hardness</b>	Rockwell C35 maximum
<b>Plating</b>	Direct tension indicator washers are usually supplied plain or zinc plated.



GRADE 5



GRADE 8

DIRECT TENSION INDICATOR WASHERS - USED W/ GRADES 5 & 8 FASTENERS								SAE J 2486	
Nominal Size	OD	ID		TH	P	Grade 5 Loads		Grade 8 Loads	
	Outside Diameter	Inside Diameter		Thickness	Protrusion Bearing Diameter	Target Clamp Load	Proof Load	Target Clamp Load	Proof Load
	Max	Max	Min	Min	Max		Min		Min
1/2	0.970	0.527	0.523	0.104	0.675	10,197	12,100	14,396	17,000
5/8	1.224	0.658	0.654	0.126	0.844	16,317	19,200	23,036	27,100
3/4	1.494	0.790	0.786	0.142	1.012	23,776	28,400	33,567	40,100
7/8	1.650	0.921	0.917	0.158	1.181	32,449	39,300	45,825	55,400
1	1.866	1.052	1.048	0.158	1.350	42,269	51,500	59,674	72,700
1 1/8	2.083	1.183	1.179	0.158	1.519	47,508	56,500	77,040	91,600
1 1/4	2.299	1.315	1.311	0.193	1.688	59,552	71,700	96,570	116,300
1 1/2	2.732	1.577	1.573	0.193	2.025	87,746	104,000	142,290	169,200

<b>Description</b>	A round washer with notches formed into its outer edge, protrusions on the top face equally spaced from each other, and corresponding pockets on the bottom face.
<b>Applications/ Advantages</b>	These washers are designed to be used with grade 5 and grade 8 cap screws. The washer is placed beneath the head of the cap screw and as the screw is tightened, the protrusions compress. When the protrusions have been flattened a sufficient amount the fastening has achieved the proper tension. Direct tension indicators are not affected by the presence of oil or other lubricants, and they measure tension regardless of surface condition. They help ensure proper tension is achieved even when a simple box wrench or socket wrench are the only tools that can be used to tighten the screw. They are used in the fleet industry, off-highway vehicles, construction, mining, and other heavy industrial equipment.
<b>Material</b>	Direct tension indicator washers shall be manufactured from a steel which conforms to the following chemical composition requirements (product analysis): <i>Carbon</i> - 0.27-0.53%; <i>Manganese</i> - 0.47-0.93%; <i>Phosphorous</i> - 0.043% maximum; <i>Sulfur</i> - 0.048% maximum; <i>Silicon</i> - 0.13-0.37%
<b>Heat Treatment</b>	Parts shall be through hardened by heating to a temperature above the upper transformation temperature, quenched in liquid, then tempered by reheating to a suitable temperature to achieve the listed mechanical and performance requirements.
<b>Hardness</b>	Rockwell C35 maximum
<b>Plating</b>	Direct tension indicator washers are usually supplied plain or zinc plated.