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VSWR	RETURN LOSS (dB)	MISMATCH LOSS (dB)
1.00		0
1.02	40.09	.0004
1.04	34.15	.0017
1.06	30.71	.0037
1.08	28.30	.0064
1.10	26.44	.0099
1.12	24.94	.014
1.14	23.69	.019
1.16	22.61	.024
1.18	21.66	.030
1.20	20.83	.036
1.22	20.08	.043
1.24	19.40	.050
1.26	18.78	.058
1.28	18.22	.066
1.30	17.69	.075
1.40	15.56	.122
1.50	13.98	.177
1.60	12.74	.238
1.70	11.73	.302
1.80	10.88	.370
1.90	10.16	.430

VSWR	RETURN LOSS (dB)	MISMATCH LOSS (dB)
2.00	9.54	.512
2.10	9.00	.584
2.20	8.52	.659
2.30	8.09	.732
2.40	7.71	.807
2.50	7.36	.881
2.75	6.60	1.06
3.0	6.02	1.25
3.25	5.54	1.45
3.5	5.10	1.60
4	4.44	1.94
5	3.52	2.56
6	2.92	3.10
7	2.50	3.60
8	2.18	4.03
9	1.94	4.44
10	1.74	4.81
20	.87	7.41
30	.58	9.04
40	.43	10.22
50	.35	11.14
	0	

# RECTANGULAR WAVEGUIDE SPECIFICATIONS

EIA WG Designation	JAN WG Designation	MIL-W-85 (DASH NO)	Material Alloy	Recommended Operating Range for TE <sub>10</sub> Mode		Cut-Off for TE <sub>10</sub> Mode		Range In 2λ	Range In λg	Recommended Power Rating (AT ONE ATMOSPHERE) cw(KW)	Theoretical attenuation lowest to highest frequency (dB/100ft)	DIMENSIONS (Inches)			Wall Thickness Nominal	
				Frequency (GHz/Sec)	Wavelength (cm)	Frequency (GHz/Sec)	Wavelength (cm)					Inside	Tol.±	Outside		Tol.±
WR430	RG104/U RG105/U	1-027 1-030	Copper Aluminum	1.70-2.60	17.63-11.53	1.375	21.84	1.61-1.06	1.70-1.18	95.0	.393-.261 .590-.392	4.300 x 2.150	.008	4.460x2.310	.008	.080
WR340	RG112/U RG113/U	1-033 1-036	Copper Aluminum	2.20-3.30	13.63-9.08	1.737	17.27	1.58-1.05	1.78-1.22	58.5	.533-.371 .801-.557	3.400 x 1.700	.005	3.560x1.860	.005	.080
WR284 R/H	-	4-015 4-016	Copper Aluminum	2.60-3.95	11.53-7.59	2.080	14.43	1.60-1.05	1.67-1.17	30.0 24.0	1.187-.897 1.784-1.348	2.840 x .670	.005	3.000x.830	.005	.080
WR284	RG48/U RG75/U	1-039 1-042	Copper Aluminum	2.60-3.95	11.53-7.59	2.080	14.43	1.60-1.05	1.67-1.17	45.0 36.0	.742-.508 1.116-.764	2.840x1.340	.005	3.000x1.500	.005	.080
WR229	RG340/U RG341/U	1-045 1-048	Copper Aluminum	3.30-4.90	9.08-6.12	2.577	11.63	1.56-1.05	1.62-1.17	30.0 24.0	.946-.671 1.422-1.009	2.290x1.145	.005	2.418x1.273	.005	.064
WR187	RG49/U RG95/U	1-051 1-054	Copper Aluminum	3.95-5.85	7.59-5.12	3.156	9.500	1.60-1.08	1.67-1.19	18.0 14.5	1.395-.967 2.097-1.454	1.872x.872	.005	2.000x1.000	.005	.064
WR159	RG343/U RG344/U	1-057 1-060	Copper Aluminum	4.90-7.05	6.12-4.25	3.705	8.092	1.51-1.05	1.52-1.19	15.0 12.0	1.593-1.160 2.334-1.744	1.590x.795	.004	1.718x.923	.004	.064
WR137	RG50/U RG106/U	1-063 1-066	Copper Aluminum	5.85-8.20	5.12-3.66	4.285	6.996	1.47-1.05	1.48-1.17	10.0 8.0	1.987-1.562 2.955-2.348	1.372x.622	.004	1.500x.750	.004	.064
WR112	RG51/U RG68/U	1-069 1-072	Copper Aluminum	7.05-10.00	4.25-2.99	5.260	5.700	1.49-1.05	1.51-1.17	6.0 4.8	2.776-2.154 4.173-3.238	1.122x.497	.004	1.250x.625	.004	.064
WR102	RG320/U	1-156	Copper Aluminum	7.00-11.00	4.28-2.72	5.786	5.182	1.65-1.05	1.78-1.18	5.0 4.0	3.516-2.217 5.285-3.333	1.020x.510	.005	1.148x.638	.005	0.64
WR96	-	4-027 4-028	Copper Aluminum	7.00-17.00	4.28-1.66	6.120	4.900	1.75-.72	2.06-1.07	2.5 2.0	5.835-3.444 8.772-5.186	.965x.320	.003	1.065x.420	.003	.050
WR90 R/H	-	4-034	Aluminum	8.20-12.40	3.66-2.42	6.560	4.572	1.60-1.06	1.68-1.18	2.0 340	10.47-9.254	.900x.200	.003	1.000x.300	.003	.050
WR90	RG52/U RG67/U	1-075 1-078	Copper Aluminum	8.20-12.40	3.66-2.42	6.560	4.572	1.60-1.06	1.68-1.18	3.0 2.4	4.238-2.995 6.506-4.502	.900x.400	.003	1.000x.500	.003	.050
WR75 R/H	-	-	Aluminum	10.00-15.00	2.99-2.00	7.869	3.820	1.57-1.05	1.64-1.17	280	7.806-5.950	.750x.200	.003	.850x.300	.003	.050
WR75	RG346/U RG347/U	1-081 1-084	Copper Aluminum	10.00-15.00	2.99-2.00	7.869	3.820	1.57-1.05	1.64-1.17	2.8 2.2	5.121-3.577 7.698-5.377	.750x.375	.003	.850x.475	.003	.050
WR67	-	-	Copper Aluminum	11.00-17.00	2.72-1.76	8.578	3.495	1.61-1.04	1.68-1.17	2.4 1.9	4.113-2.744 6.184-4.126	.668x.340	.002	.750x.420	.003	.040
WR62	RG91/U RG349/U	1-087 1-091	Copper Aluminum	12.40-18.00	2.42-1.66	9.490	3.160	1.53-1.05	1.55-1.18	1.8 1.4	6.451-4.743 9.700-7.131	.622x.311	.002	.702x.391	.003	.040
WR51	RG352/U RG351/U	1-094 1-098	Copper Aluminum	15.00-22.00	2.00-1.36	11.54	2.598	1.54-1.05	1.57-1.18	1.2 1.0	8.812-6.384 13.250-9.598	.510x.255	.002	.590x.335	.003	.040
WR42	RG53/U RG121/U	1-100 1-104	Copper Aluminum	18.00-26.50	1.66-1.13	14.080	2.134	1.56-1.06	1.60-1.18	0.8 0.6	13.80-10.13 20.74-15.23	.420x.170	.002	.500x.250	.003	.040
WR34	RG354/U RG355/U	1-107 1-111	Copper Aluminum	22.00-33.00	1.36-.91	17.28	1.735	1.58-1.05	1.63-1.18	0.6 0.5	16.86-11.73 25.35-17.63	.340x.170	.002	.420x.250	.003	.040
WR28	RG271/U	3-007 3-009	Copper Aluminum	26.50-40.00	1.13-.75	21.10	1.422	1.59-1.05	1.65-1.17	0.5 0.4	23.02-15.77 34.46-23.59	.280x.140	.001	.360x.220	.002	.040
WR22	RG272/U	3-011	Copper	33.00-50.00	.91-.60	26.350	1.138	1.60-1.05	1.67-1.17	0.4 60	32.44-22.05	.224x.112	.001	.304x.192	.002	.040
WR19	RG358/U	3-015	Copper	40.00-60.00	.75-.50	30.690	.956	1.57-1.05	1.63-1.16	0.3 50	39.81-28.60	.188x.094	.001	.268x.174	.002	.040

## DESIGN AIDS

DS-501

**Continental Microwave & Tool Company, Inc.**  
**A Chelton Microwave Company**

11 Continental Drive, Exeter, NH 03833-4564  
 Tel: (603)775-5200 • e-mail: ctm@contmicro.com • fax: (603)775-5201 • URL: www.contmicro.com

# FLANGE SPECIFICATIONS - RECTANGULAR & DOUBLE RIDGE

Waveguide Size	Material	JAN DESIGNATION				MIL DESIGNATION-MIL-F-3922( )				*CMR
		*Cover Flange	Choke Flange	CPR Contact	CPR Flat	*Cover Flange	Choke Flange	CPR Contact	CPR Flat	
WR-19	Brass	---	---	---	---	67-007	---	---	---	---
WR-22	Brass	UG-383/U	---	---	---	67-006	---	---	---	---
	Aluminum	---	---	---	---	67-013	---	---	---	---
WR-28	Brass	UG-599/U	UG-600A/U	---	---	54-003	---	---	---	---
	Aluminum	---	---	---	---	---	---	---	---	---
WR-42	Brass	UG-595/U	UG-596A/U	---	---	54-001	---	---	---	---
	Aluminum	UG-597/U	UG-598A/U	---	---	54-002	---	---	---	---
WR-51	Brass	---	---	---	---	70-010	---	---	---	---
	Aluminum	---	---	---	---	70-011	---	---	---	---
WR-62	Brass	UG-419/U	UG-541/U	---	---	53-005	---	---	---	---
	Aluminum	UG-1665/U	UG-1666/U	---	---	53-006	---	---	---	---
WR-75	Brass	---	---	---	---	53-007	---	---	---	---
	Aluminum	---	---	---	---	53-008	---	---	---	---
WR-90	Brass	UG-39/U	UG-40B/U	UG-1360/U	UG-1736/U	53-001	59-006	52-043	52-021	63-004
	Aluminum	UG-135/U	UG-136B/U	UG-1361/U	UG-1737/U	53-003	59-008	52-044	52-022	63-008
WR-102	Brass	UG-1493/U	UG-1494/U	---	---	70-001	---	---	---	---
	Aluminum	---	---	---	---	70-002	---	---	---	---
WR-112	Brass	UG-51/U	UG-52B/U	UG-1358/U	UG-1734/U	53-002	59-007	52-041	52-019	63-003
	Aluminum	UG-138/U	UG-137B/U	UG-1359/U	UG-1735/U	53-004	59-009	52-042	52-020	63-007
WR-137	Brass	UG-344/U	UG-343B/U	UG-1356/U	UG-1732/U	55-001	60-001	52-039	52-017	63-002
	Aluminum	UG-441/U	UG-440B/U	UG-1357/U	UG-1733/U	55-002	60-002	52-040	52-018	63-006
WR-159	Brass	---	---	UG-1354/U	UG-1730/U	---	---	52-037	52-015	---
	Aluminum	---	---	UG-1355/U	UG-1731/U	---	---	52-038	52-016	---
WR-187	Brass	UG-149A/U	UG-148C/U	UG-1352/U	UG-1728/U	57-002	62-002	52-035	52-013	63-001
	Aluminum	UG-407/A	UG-406B/U	UG-1353/U	UG-1729/U	57-001	62-001	52-036	52-014	63-005
WR-229	Brass	---	---	UG-1350/U	UG-1726/U	---	---	52-033	52-011	---
	Aluminum	---	---	UG-1351/U	UG-1727/U	---	---	52-034	52-012	---
WR-284	Brass	UG-53/U	UG-54B/U	UG-1348/U	UG-1724/U	56-001	61-002	52-031	52-009	64-001
	Aluminum	UG-584/U	UG-585/U	UG-1349/U	UG-1725/U	56-002	61-001	52-032	52-010	64-002
WR-340	Brass	---	---	UG-1346/U	UG-1712/U	---	---	52-029	52-007	---
	Aluminum	---	---	UG-1347/U	UG-1713/U	---	---	52-030	52-008	---
WR-430	Brass	---	---	UG-1344/U	UG-1716/U	---	---	52-027	52-005	---
	Aluminum	---	---	UG-1345/U	UG-1711/U	---	---	52-028	52-006	---

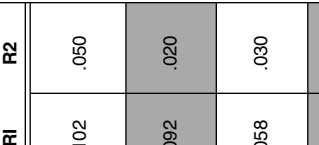
  

Waveguide Size	Material	Cover Flange-Mil-F-39000( )		Gasket Flange-Mil-F-39000( )	
		All Clear	Alternate	All Clear	Alternate
WRD-180	Aluminum	3-088	3-084	---	---
	Brass	3-089	3-085	---	---
WRD-750	Aluminum	3-076	3-072	3-080	3-078
	Brass	3-077	3-073	3-081	3-079
WRD-475	Aluminum	3-040	3-036	3-062	3-060
	Brass	3-041	3-037	3-063	3-061
WRD-350	Aluminum	3-034	3-030	3-056	3-054
	Brass	3-035	3-031	3-057	3-055

\*Flange designations referenced are for thru-type flanges. Excluding Fig 19 and Fig 22, all C.M.T. flanges offered butt-style only.



# DOUBLE RIDGE WAVEGUIDE SPECIFICATIONS



Waveguide Size	MIL-W-23351 Dash No.	Material	Recommended Frequency Range TE <sub>1,0</sub> Mode(GHz)	(3) Cut-Off Frequency for TE <sub>1,0</sub> Mode(GHz)	(1) F-3Fc <sub>1,0</sub> Theoretical Attenuation Decibels/Foot	Recommended Power Rating (AT ONE ATMOSPHERE) cw(KW) peak(KW)	Dimensions (inches)							
							A	B	C	D	E	F	RI	R2
WRD 200D24	4-025	Aluminum Alloy	2.00-4.80	1.666	0.0134	50.0	1.205	1.365	.648	.512	.102	.050		
	4-026	Brass					1.205	1.365	.648	.512	.102	.050		
	4-027	Copper					1.205	1.365	.648	.512	.102	.050		
WRD 250D30	4-028	Silver Alloy	2.60-7.80	2.093	0.0089	24.0	1.655	1.000	.440	.150	.092	.020		
	4-029	Aluminum Alloy					1.655	1.000	.440	.150	.092	.020		
	4-030	Brass					1.655	1.000	.440	.150	.092	.020		
WRD 350D24	4-031	Copper	3.50-8.20	2.915	0.0095	18.0	1.480	.688	1.608	.816	.370	.292	.030	
	4-032	Silver Alloy					1.480	.688	1.608	.816	.370	.292	.030	
	4-033	Aluminum Alloy					1.480	.688	1.608	.816	.370	.292	.030	
WRD 475D24	4-034	Brass	4.75-11.00	3.961	0.0225	8.0	1.090	.506	1.190	.606	.272	.215	.030	
	4-035	Copper					1.090	.506	1.190	.606	.272	.215	.030	
	4-036	Silver Alloy					1.090	.506	1.190	.606	.272	.215	.030	
WRD 500D36	2-025	Aluminum Alloy	5.00-18.00	4.222	0.0307	4.0	.752	.323	.852	.423	.188	.063	.020	
	2-026	Brass					.752	.323	.852	.423	.188	.063	.020	
	2-027	Copper					.752	.323	.852	.423	.188	.063	.020	
WRD 580D28	2-028	Silver Alloy	5.80-16.00	4.892	0.0218	5.2	.780	.370	.880	.470	.200	.120	.043	
	2-029	Aluminum Alloy					.780	.370	.880	.470	.200	.120	.043	
	2-030	Brass					.780	.370	.880	.470	.200	.120	.043	
WRD 650D28	4-037	Aluminum Alloy	6.50-18.00	5.348	0.0481	4.0	.720	.321	.820	.421	.173	.101	.020	
	4-038	Brass					.720	.321	.820	.421	.173	.101	.020	
	4-039	Copper					.720	.321	.820	.421	.173	.101	.020	
WRD 700D26	4-040	Silver Alloy	7.00-18.50	5.679	0.0324	4.3	.686	.310	.786	.410	.173	.105	.020	
	4-041	Aluminum Alloy					.686	.310	.786	.410	.173	.105	.020	
	4-042	Brass					.686	.310	.786	.410	.173	.105	.020	
WRD 750D24	4-043	Copper	7.50-18.00	6.239	0.0347	4.8	.691	.321	.791	.421	.173	.136	.020	
	4-044	Silver Alloy					.691	.321	.791	.421	.173	.136	.020	
	4-045	Aluminum Alloy					.691	.321	.791	.421	.173	.136	.020	
WRD 110C24	4-046	Aluminum Alloy	11.00-26.50	9.363	0.109	1.4	.471	.219	.551	.299	.118	.093	.015	
	4-047	Brass					.471	.219	.551	.299	.118	.093	.015	
	4-048	Copper					.471	.219	.551	.299	.118	.093	.015	
WRD 180C24	4-049	Silver Alloy	18.00-44.00	14.995	0.108	0.8	.288	.134	.368	.214	.072	.057	.015	
	4-050	Aluminum Alloy					.288	.134	.368	.214	.072	.057	.015	
	4-051	Brass					.288	.134	.368	.214	.072	.057	.015	

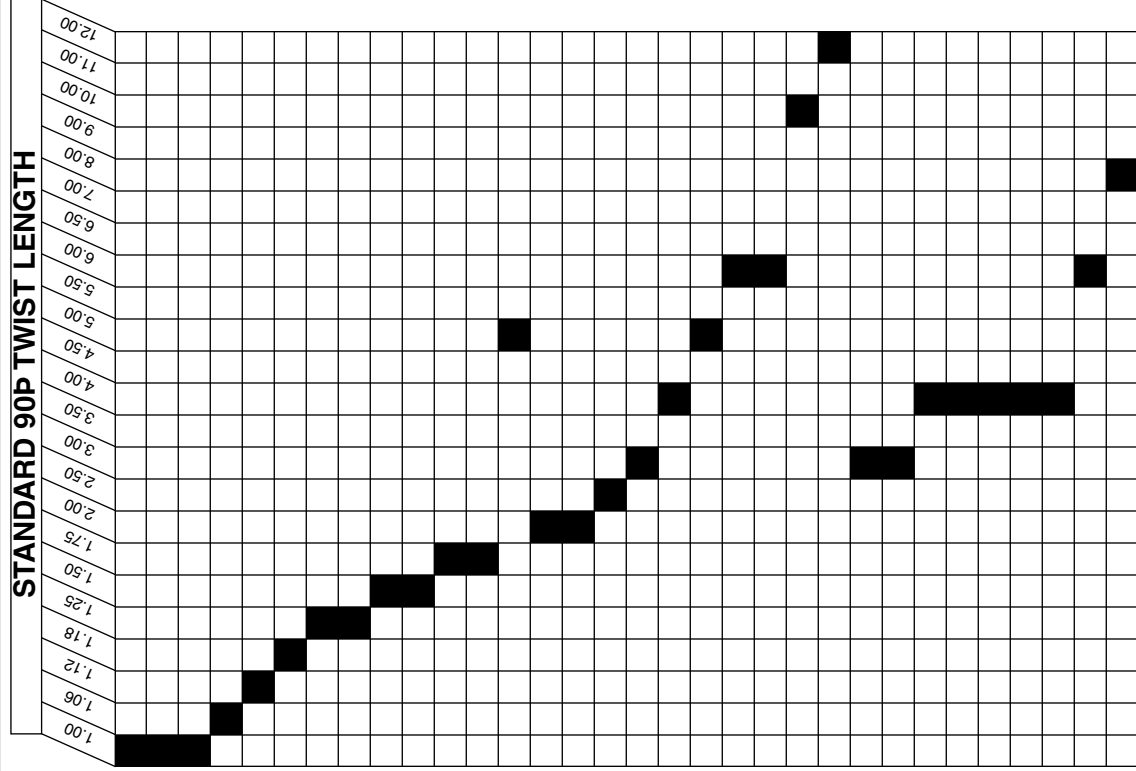
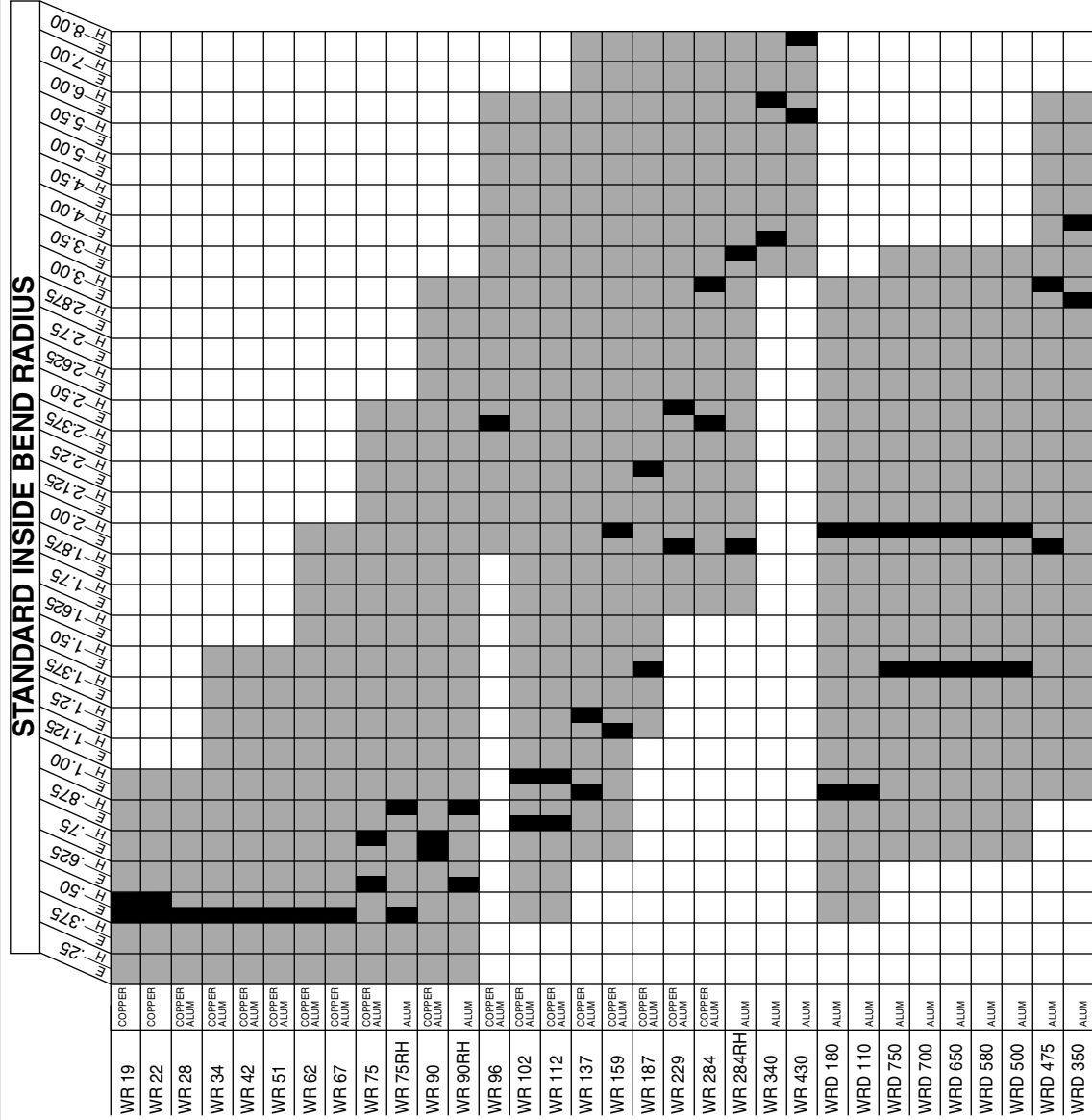
(1) Typical resistivities of materials (at 20°C); Aluminum alloy (6061)=4.00 microhm-cm; Brass-3.9 microhm-cm; Copper=1.77 microhm-cm; Silver alloy (coin silver)=2.03 microhm-cm.  
 (2) Based on the E field produced breakdown in a non-pressurized air dielectric waveguide under continuous wave (cw) conditions. The breakdown strength of air was considered to be 15,000 volts per centimeter, corner radii considered.  
 (3) fc<sub>1,0</sub> = cutoff frequency for TE<sub>1,0</sub> mode.

## DESIGN AIDS

**Continental Microwave & Tool Company, Inc.**  
 A Chelton Microwave Company

11 Continental Drive, Exeter, NH 03833-4564  
 Tel: (603)775-5200 • e-mail: cmt@contmicro.com • fax: (603)775-5201 • URL: www.contmicro.com

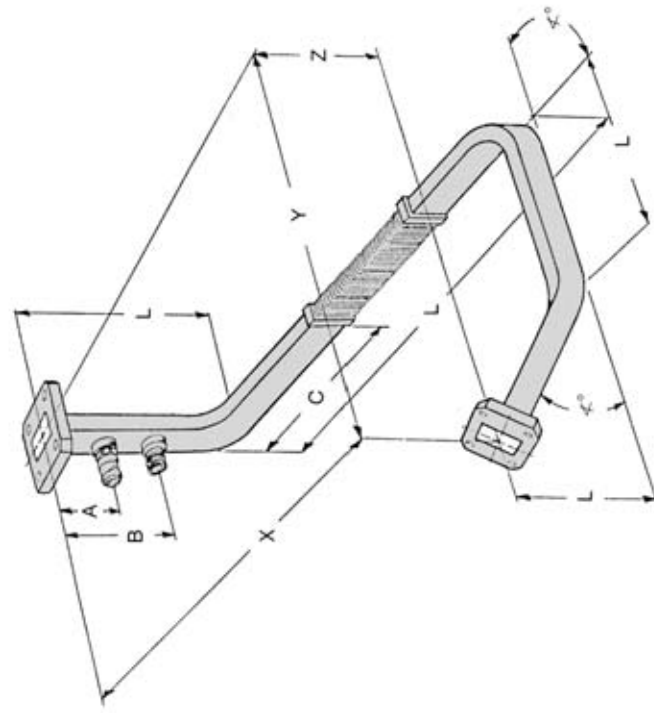
# STANDARD BEND RADII & TWIST LENGTHS FOR RIGID WAVEGUIDE TUBING



■ Indicates C.M.T. standard bend radius or twist length  
 Shaded area indicates range of C.M.T. bending tools in stock.  
 Due to the continual expansion of tooling inventory, it is suggested that C.M.T. be contacted if a desired bend radius is not listed.

## RECTANGULAR WAVEGUIDE

Waveguide Sizes	Closure Dimensions (x,y,z) 0"-18"   18"-36"   36"+	Closure Dimensions (x,y,z) 0"-18"   18"-36"   36"+	Closure Dimensions (x,y,z) 0"-18"   18"-36"   36"+	Bend Locations (L)	Bend Angles (<math>\leq b</math>)	Segment & Feature Locations (A,B,C)				
Rigid Assemblies	WR-19 to WR-42	.01	.02	.03	.010	.015	.020	.015	1	.010
	WR-51 to WR-75 R/H	.02	.03	.04	.010	.015	.020	.030	1	.015
	WR-90 to WR-112	.03	.04	.05	.010	.015	.020	.045	1	.020
	WR-137 to WR-187	.04	.05	.06	.010	.015	.020	.060	2	.025
	WR-229 to WR-430	.05	.06	.07	.010	.015	.020	.090	3	.030
Flex Assemblies	WR-22 to WR-42	.02	.03	.04	.010	.015	.020	.015	1	.010
	WR-51 to WR-75 R/H	.04	.05	.06	.010	.015	.020	.030	1	.015
	WR-90 to WR-112	.06	.07	.08	.010	.015	.020	.045	2	.020
	WR-137 to WR-187	.08	.09	.10	.010	.015	.020	.060	2	.025
	WR-229 to WR-284	.10	.12	.15	.010	.015	.020	.090	3	.030
Rigid/Flex Assemblies	WR-22 to WR-42	.02	.03	.04	.010	.015	.020	.015	1	.010
	WR-51 to WR-75 R/H	.04	.05	.06	.010	.015	.020	.030	1	.015
	WR-90 to WR-112	.06	.07	.08	.010	.015	.020	.045	2	.020
	WR-137 to WR-187	.08	.09	.10	.010	.015	.020	.060	2	.025
	WR-229 to WR-284	.10	.12	.15	.010	.015	.020	.090	3	.030
	(+/-)	(+/-)	(+/-)	(+/-)	(+/-)	(+/-)	(+/-)	(+/-)	(+/-)	(+/-)

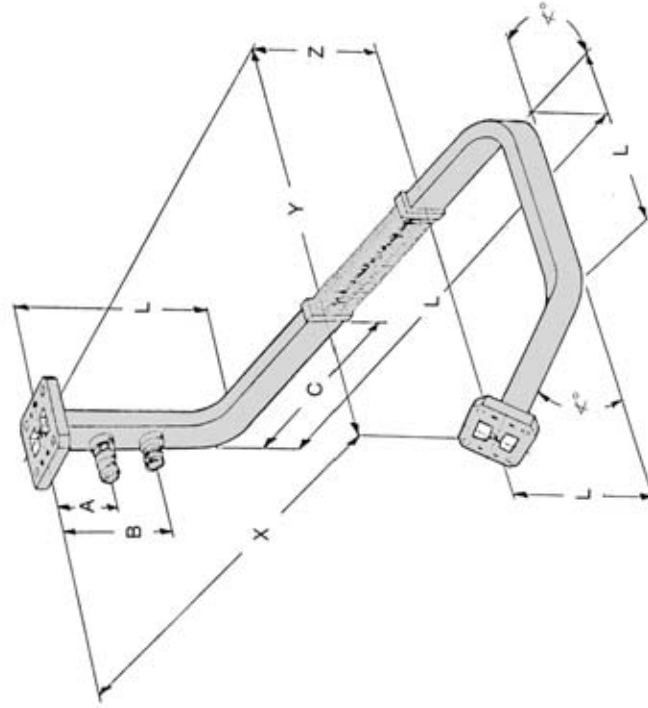


- 1 Nominal closure dimension tolerance without use of assay/inspection fixtures.
- 2 Nominal closure dimension tolerance with use of assay/inspection fixtures.

# C.M.T. DIMENSIONAL TOLERANCE STANDARDS FOR CUSTOM WAVEGUIDE ASSEMBLIES

## DOUBLE RIDGE WAVEGUIDE

Waveguide Sizes	1 Closure Dimensions (x,y,z) 0"-18" 18"-36" 36"+		2 Closure Dimensions (x,y,z) 0"-18" 18"-36" 36"+		Bend Locations (L)	Bend Angles ( $\angle P$ )	Segment & Feature Locations (A,B,C)	
WRD-180 WRD-110	.01	.02	.03	.010	.015	.020	.030	.015
WRD-750 WRD-700 WRD-650 WRD-580 WRD-500	.02	.03	.04	.010	.015	.020	.060	.030
WRD-475 WRD-350	.03	.04	.05	.010	.015	.020	.090	.030
WRD-750 WRD-700 WRD-650 WRD-580	.03	.06	.09	.010	.015	.020	.060	.030
WRD-475 WRD-350	.05	.09	.12	.010	.015	.020	.090	.030
WRD-750 WRD-700 WRD-650 WRD-580	.03	.06	.09	.010	.015	.020	.060	.030
WRD-475 WRD-350	.05	.09	.12	.010	.015	.020	.090	.030
	(+/-)	(+/-)	(+/-)	(+/-)	(+/-)	(+/-)	(+/-)	(+/-)



- 1 Nominal closure dimension tolerance without use of assy/inspection fixtures.
- 2 Nominal closure dimension tolerance with use of assy/inspection fixtures.

## DESIGN AIDS



**Continental Microwave & Tool Company, Inc.**  
**A Chelton Microwave Company**

11 Continental Drive, Exeter, NH 03833-4564  
 Tel: (603)775-5200 • e-mail: cmt@contmicro.com • fax: (603)775-5201 • URL: www.contmicro.com

# ELECTRICAL SPECIFICATIONS FOR C.M.T. WAVEGUIDE ASSEMBLIES

Insertion Loss Characteristic (dB)										(1) V.S.W.R. (Full Waveguide Band)					
W/G Size	Rigid Alum. (Per Inch)	Rigid OFHC (Per Inch)	Flex (Per Inch)	F/R Union (Ea.)	R/R Union (Ea.)	Pressure Window (Ea.)	Coupler Section (Ea.)	Flange Set (Per Set)	Base Assy Cal.	Flex 1 to 12 in. (Ea. Sect)	Flex 13 to 36 in. (Ea. Sect)	W/G Band (Ea.)	Union (Ea.)	Pressure Window (Ea.)	X/Non Inc. Unions (Ea.)
WR19	-	.030	-	.150	.100	.15	.010	.120	1.20	-	-	.06	.05	.12	.15
WR22	-	.030	.050	.150	.100	.12	.010	.100	1.18	.20	.30	.06	.05	.12	.15
WR28	.040	.020	.040	.120	.080	.10	.010	.070	1.12	.10	.15	.04	.04	.10	.12
WR34	.030	.014	.030	.100	.090	.10	.008	.060	1.12	.10	.12	.04	.04	.08	.10
WR42	.020	.014	.030	.060	.050	.10	.006	.050	1.10	.08	.10	.03	.03	.06	.10
WR51	.012	.009	.020	.050	.050	.10	.005	.040	1.08	.06	.09	.03	.03	.06	.10
WR62	.008	.006	.012	.040	.030	.09	.005	.030	1.06	.05	.08	.02	.02	.05	.08
WR67	.008	.006	.012	.040	.030	.10	.005	.030	1.06	.05	.08	.02	.02	.06	.06
WR75	.006	.005	.010	.030	.020	.08	.005	.020	1.06	.05	.08	.02	.02	.05	.05
WR75 RH	-	-	.010	.030	.020	.08	.005	.020	1.08	.05	.08	.02	.03	.05	.05
WR90	.005	.004	.010	.025	.015	.07	.005	.020	1.06	.05	.08	.02	.02	.05	.05
WR90 RH	.010	-	.010	.025	.015	.07	.005	.020	1.08	.05	.08	.03	.03	.05	.05
WR96	.008	.005	-	.020	.015	.08	.005	.030	1.08	-	-	.02	.02	.05	.05
WR102	.004	.003	.008	.025	.015	.07	.005	.015	1.06	.05	.08	.02	.02	.05	.05
WR112	.004	.003	.008	.025	.015	.06	.005	.015	1.06	.05	.08	.02	.02	.05	.05
WR137	.003	.002	.005	.020	.010	.05	.005	.010	1.05	.05	.08	.01	.01	.05	.05
WR159	.002	.002	.003	.020	.005	.04	.005	.007	1.05	.05	.08	.02	.02	.05	.05
WR187	.002	.001	.003	.015	.004	.04	.005	.005	1.05	.05	.08	.02	.02	.05	.05
WR229	.001	.001	.002	.010	.003	.03	.005	.003	1.04	.05	.08	.01	.02	.05	.05
WR284	.001	.001	.002	.010	.002	.02	.005	.002	1.03	.04	.08	.01	.02	.05	.05
WR284 RH	.002	-	-	.003	.003	.02	.005	.002	1.04	-	-	.02	.02	.05	.05
WR340	.001	-	-	.002	.002	.02	-	.002	1.03	-	-	.02	.02	.05	.05
WR430	.001	-	-	.002	.002	.02	-	.002	1.03	-	-	.02	.02	.05	.05
WRD180	.030	-	-	.100	.100	.25	.010	.120	1.25	-	-	.05	.05	.15	.15
WRD110	.020	-	-	.080	.080	.20	.010	.100	1.20	-	-	.05	.04	.12	.10
WRD750	.010	-	.017	.075	.040	.08	.010	.070	1.10	.10	.18	.02	.02	.08	.10
WRD700	.011	-	.017	.075	.040	.08	.010	.070	1.10	.10	.18	.02	.02	.08	.10
WRD650	.013	-	.020	.080	.050	.10	.010	.080	1.15	.10	.20	.03	.03	.10	.10
WRD580	.012	-	.017	.075	.040	.08	.010	.070	1.10	.10	.18	.02	.02	.08	.10
WRD500	.015	-	-	-	-	.15	.010	.100	1.20	-	-	.05	.04	.15	.15
WRD475	.005	-	.013	.060	.025	.08	.010	.050	1.10	.10	.15	.02	.02	.08	.10
WRD350	.003	-	.010	.030	.015	.05	.010	.030	1.08	.12	.20	.02	.02	.08	.10

(1) VSWR Approximation for reduced frequency band

Full Waveguide Band VSWR	80%	50%	25%	10%
1.10	1.09	1.08	1.06	1.05
1.15	1.14	1.12	1.09	1.08
1.20	1.18	1.16	1.12	1.13
1.25	1.23	1.20	1.15	1.13
1.30	1.27	1.24	1.18	1.15
1.35	1.32	1.28	1.21	1.18
1.40	1.36	1.32	1.24	1.20
1.50	1.45	1.40	1.30	1.25

$$\% = \left( \frac{F_H - F_L}{F_H + F_L} \right) \times 100$$

Contact CMT Applications Engineering for enhanced V.S.W.R. Performance Over Partial Waveguide Frequency Bands.

DESIGN AIDS

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11 Continental Drive, Exeter, NH 03833-4564  
 Tel: (603)775-5200 • e-mail: cmt@contmicro.com • fax: (603)775-5201 • URL: www.contmicro.com



# RECTANGULAR & DOUBLE RIDGE WAVEGUIDE CHARACTERISTICS

Model	Freq. (GHz)	F/W (in)	W/G (in)	VEL. PROP (% of C)	Td (nS/ft)	W/G Z (Ohms)	1 deg (deg)	Freq. (GHz)	F/W (in)	W/G (in)	VEL. PROP (% of C)	Td (nS/ft)	W/G Z (Ohms)	1 deg (deg)
WR-19	40.0000	0.2951	0.4761	0.6198	1.6404	477	0.0013	8.2000	1.4394	2.3971	0.6005	1.6932	219	0.0067
	45.0000	0.2623	0.3661	0.7165	1.4189	413	0.0010	9.2500	1.2760	1.8091	0.7053	1.4415	186	0.0050
	50.0000	0.2361	0.3033	0.7784	1.3062	380	0.0008	10.3000	1.1459	1.4859	0.7712	1.3184	170	0.0041
	55.0000	0.2146	0.2610	0.8211	1.2382	360	0.0007	11.3500	1.0399	1.2740	0.8162	1.2456	161	0.0035
	60.0000	0.1967	0.2308	0.8522	1.1930	347	0.0006	12.4000	0.9518	1.1215	0.8487	1.1979	155	0.0031
	65.0000	0.1819	0.2093	0.8764	1.1644	334	0.0005	13.4500	0.8841	1.0635	0.8847	1.1644	144	0.0028
WR-22	33.0000	0.3577	0.5939	0.6022	1.6683	491	0.0016	7.0000	1.6861	3.4653	0.4866	2.0895	403	0.0096
	37.5000	0.3169	0.4482	0.7069	1.4282	418	0.0012	9.5000	1.2424	2.3285	0.6235	1.8286	256	0.0046
	41.5000	0.2844	0.3681	0.7726	1.3159	383	0.0010	10.5000	1.1452	1.9836	0.7053	1.6818	228	0.0032
	45.5000	0.2580	0.3156	0.8175	1.2436	362	0.0009	11.5000	1.0640	1.8077	0.7677	1.5813	216	0.0025
	50.0000	0.2361	0.2777	0.8499	1.1962	348	0.0008	12.0000	0.9843	1.7441	0.8031	1.5313	210	0.0021
	55.0000	0.2193	0.2462	0.8764	1.1644	334	0.0007	13.0000	0.9219	1.6818	0.8487	1.5313	200	0.0019
WR-28	26.5000	0.4454	0.7348	0.6062	1.6773	488	0.0020	7.0000	1.6861	2.9955	0.5629	1.8062	526	0.0083
	29.8750	0.3951	0.5574	0.7087	1.4346	417	0.0015	8.0000	1.4754	2.1363	0.6906	1.4721	428	0.0059
	33.2500	0.3550	0.4590	0.7734	1.3145	382	0.0013	9.0000	1.3114	1.7121	0.7660	1.3273	388	0.0048
	36.6250	0.3223	0.3940	0.8178	1.2432	362	0.0011	10.0000	1.1803	1.4471	0.8156	1.2465	363	0.0040
	40.0000	0.2951	0.3472	0.8499	1.1962	348	0.0010	11.0000	1.0730	1.2616	0.8505	1.1954	348	0.0035
	45.0000	0.2657	0.2971	0.8764	1.1644	334	0.0009	12.0000	0.9843	1.1979	0.8487	1.1979	334	0.0031
WR-34	22.0000	0.5365	0.8731	0.6144	1.6547	481	0.0024	7.0500	1.6742	2.5142	0.6659	1.5269	393	0.0070
	24.7500	0.4769	0.6690	0.7129	1.4262	415	0.0019	7.7875	1.5156	2.0552	0.7374	1.3787	355	0.0057
	27.5000	0.4292	0.5533	0.7756	1.3108	381	0.0015	8.5250	1.3845	1.7593	0.7670	1.2919	333	0.0049
	30.2500	0.3902	0.4764	0.8190	1.2414	361	0.0013	9.2625	1.2743	1.5481	0.8231	1.2352	318	0.0043
	33.0000	0.3577	0.4205	0.8505	1.1954	348	0.0012	10.0000	1.1803	1.3878	0.8505	1.1954	308	0.0039
	37.5000	0.3169	0.3577	0.8764	1.1644	334	0.0010	11.0000	1.0730	1.2616	0.8505	1.1954	308	0.0039
WR-42	18.0000	0.6557	1.0491	0.6250	1.6267	383	0.0029	5.8500	2.0176	2.9768	0.6778	1.5001	396	0.0083
	20.1250	0.5985	0.8192	0.7159	1.4201	334	0.0023	6.4375	1.8035	2.4643	0.7440	1.3665	360	0.0068
	22.2500	0.5505	0.6841	0.7754	1.3112	309	0.0019	7.0250	1.6001	2.1250	0.7906	1.2859	339	0.0050
	24.3750	0.4942	0.5626	0.8171	1.2442	293	0.0016	7.6125	1.5505	1.9792	0.8251	1.2323	325	0.0052
	26.5000	0.4454	0.4523	0.8479	1.1991	282	0.0015	8.2000	1.4394	1.6906	0.8514	1.1942	315	0.0047
	30.2500	0.3902	0.3764	0.8764	1.1644	282	0.0013	9.0000	1.3114	1.4471	0.8156	1.2465	363	0.0040
WR-51	15.0000	0.7969	1.2366	0.6363	1.5978	465	0.0034	4.9000	2.4087	3.6895	0.6529	1.5573	453	0.0102
	16.7500	0.7046	0.9746	0.7230	1.4062	409	0.0027	5.4375	2.1706	2.9702	0.7308	1.3912	405	0.0083
	18.5000	0.6380	0.8177	0.7802	1.3031	379	0.0023	5.9750	1.9754	2.5207	0.7637	1.2974	377	0.0070
	20.2500	0.5829	0.7102	0.8207	1.2389	360	0.0020	6.5125	1.8123	2.2036	0.8217	1.2373	360	0.0061
	22.0000	0.5365	0.6308	0.8505	1.1954	348	0.0018	7.0500	1.6742	1.9692	0.8502	1.1958	348	0.0055
	26.5000	0.4454	0.4523	0.8479	1.1991	282	0.0015	8.2000	1.4394	1.6906	0.8514	1.1942	315	0.0047
WR-62	12.4000	0.9518	1.4783	0.6439	1.5791	459	0.0041	3.9500	2.9881	4.9592	0.6025	1.8874	457	0.0138
	13.8000	0.8553	1.1778	0.7262	1.4001	407	0.0033	4.4250	2.6673	3.8009	0.7018	1.4488	393	0.0106
	15.2000	0.7765	0.9939	0.7813	1.3013	378	0.0028	4.9000	2.4087	3.1464	0.7656	1.3280	360	0.0087
	16.6000	0.7110	0.8665	0.8206	1.2390	360	0.0024	5.3750	2.1959	2.7111	0.8099	1.2553	340	0.0075
	18.0000	0.6557	0.7716	0.8498	1.1964	348	0.0021	5.8500	2.0176	2.3951	0.8424	1.2069	327	0.0067
	22.0000	0.5365	0.6308	0.8505	1.1954	348	0.0018	7.0500	1.6742	1.9692	0.8502	1.1958	348	0.0055
WR-67	11.0000	1.0730	1.8009	0.5958	1.7064	505	0.0050	3.0000	3.5766	5.7260	0.6246	1.8277	474	0.0159
	12.5000	0.9442	1.3347	0.7075	1.4371	426	0.0037	3.7000	3.1900	4.4456	0.7176	1.4159	412	0.0123
	14.0000	0.8431	1.0968	0.7758	1.3106	388	0.0030	4.1000	2.8787	3.7103	0.7778	1.3072	380	0.0103
	15.5000	0.7615	0.9267	0.8217	1.2374	366	0.0026	4.5000	2.6229	3.1995	0.8198	1.2402	361	0.0089
	17.0000	0.6943	0.8126	0.8544	1.1900	352	0.0023	4.9000	2.4087	2.8321	0.8505	1.1954	348	0.0079
	22.0000	0.5365	0.6308	0.8505	1.1954	348	0.0018	7.0500	1.6742	1.9692	0.8502	1.1958	348	0.0055
WR-75	10.0000	1.1803	1.9125	0.6171	1.6475	479	0.0053	2.8000	4.5396	7.5528	0.6010	1.6916	464	0.0210
	11.2500	1.0491	1.4679	0.7147	1.4225	414	0.0041	3.2000	3.9500	6.0100	0.7018	1.4384	395	0.0158
	12.5000	0.9442	1.2152	0.7770	1.3085	381	0.0034	3.7500	3.6039	4.6627	0.7729	1.3154	361	0.0130
	13.7500	0.8584	1.0467	0.8201	1.2398	361	0.0029	4.2000	3.2672	3.9942	0.8180	1.2429	341	0.0111
	15.0000	0.7869	0.9242	0.8514	1.1942	347	0.0026	4.6000	2.9881	3.5135	0.8504	1.1955	328	0.0098
	22.0000	0.5365	0.6308	0.8505	1.1954	348	0.0018	7.0500	1.6742	1.9692	0.8502	1.1958	348	0.0055
WR-75 R/H	10.0000	1.1803	1.9125	0.6171	1.6475	255	0.0053	2.8000	4.5396	7.5528	0.6010	1.6916	222	0.0210
	11.2500	1.0491	1.4679	0.7147	1.4225	220	0.0041	3.2000	3.9500	6.0100	0.7018	1.4384	197	0.0158
	12.5000	0.9442	1.2152	0.7770	1.3085	203	0.0034	3.7500	3.6039	4.6627	0.7729	1.3154	180	0.0130
	13.7500	0.8584	1.0467	0.8201	1.2398	192	0.0029	4.2000	3.2672	3.9942	0.8180	1.2429	170	0.0111
	15.0000	0.7869	0.9242	0.8514	1.1942	185	0.0026	4.6000	2.9881	3.5135	0.8504	1.1955	164	0.0098
	22.0000	0.5365	0.6308	0.8505	1.1954	348	0.0018	7.0500	1.6742	1.9692	0.8502	1.1958	348	0.0055
WR-80	8.2000	1.4394	2.9241	0.6005	1.6932	438	0.0067	2.6000	5.3649	8.7314	0.6144	1.6547	481	0.0243
	9.2500	1.2760	1.8091	0.7053	1.4415	373	0.0050	2.4750	4.7688	6.8896	0.7129	1.4262	415	0.0186
	10.3000	1.1459	1.4859	0.7712	1.3184	341	0.0041	2.7500	4.2919	5.5334	0.7756	1.3108	381	0.0154
	11.3500	1.0399	1.2740	0.8162	1.2456	322	0.0035	3.0250	3.9018	4.7641	0.8156	1.2414	361	0.0132
	12.4000	0.9518	1.1215	0.8487	1.1954	308	0.0031	3.3000	3.5766	4.2053	0.8505	1.1954	348	0.0117
	13.4500	0.8841	1.0635	0.8847	1.1644	299	0.0028	3.5750	3.2672	3.9942	0.8180	1.2429	341	0.0111
WRD-180 C24	17.0000	6.9429	11.7650	0.5901	1.7228	501	0.0327	1.7000	6.9429	11.7650	0.5901	1.7228	501	0.0327
	19.2500	6.1314	8.7439	0.7012	1.4499	422	0.0243	2.1500	5.4897	7.1317	0.7698	1.3208	384	0.0198
	21.5000	5.4897	7.1317	0.7698	1.3208	384	0.0198	2.6000	4.5396	6.0982	0.8161	1.2458	362	0.0169
	23.7500	4.9696	6.0982	0.8161	1.2458	362	0.0169	2.6000	4.5396	6.0982	0.8161			

# TEMPERATURE CONVERSION TABLE

## INSTRUCTIONS

To convert from Celsius to Fahrenheit:

1. Find Celsius degrees in center column.
2. Read equivalent Fahrenheit degrees in right hand column.

To convert from Fahrenheit to Celsius:

1. Find Fahrenheit degrees in center column.
2. Read equivalent Celsius degrees in left hand column.

-459.4	TO	0	C.	F.	-15.6	4	39.2	24.4	76	168.8	282	540	1004	
C.	F.	F.	-53.9	-65	-85.0	-15.0	5	41.0	77	170.6	288	550	1022	
-273	-459.4		-53.3	-64	-83.2	-14.4	6	42.8	78	172.4	293	560	1040	
-268	-450		-52.8	-63	-81.4	-13.9	7	44.6	79	174.2	299	570	1058	
-262	-440		-52.2	-62	-79.6	-13.3	8	46.4	80	176.0	304	580	1076	
-257	-430		-51.7	-61	-77.8	-12.8	9	48.2	81	177.8	310	590	1094	
-251	-420		-51.1	-60	-76.0	-12.2	10	50.0	82	179.6	316	600	1112	
-246	-410		-50.6	-59	-74.4	-11.7	11	51.8	83	181.4	321	610	1130	
-240	-400		-50.0	-58	-72.4	-11.1	12	53.6	84	183.2	327	620	1148	
-234	-390		-49.4	-57	-70.6	-10.6	13	55.4	85	185.0	332	630	1166	
-229	-380		-48.9	-56	-68.8	-10.0	14	57.2	86	186.8	338	640	1184	
-223	-370		-48.3	-55	-67.0	-9.44	15	59.0	87	188.6	343	650	1202	
-218	-360		-47.8	-54	-65.2	-8.89	16	60.8	88	190.4	349	660	1220	
-212	-350		-47.2	-53	-63.4	-8.33	17	62.6	89	192.2	354	670	1238	
-207	-340		-46.7	-52	-61.6	-7.78	18	64.4	90	194.0	360	680	1258	
-201	-330		-46.1	-51	-59.8	-7.22	19	66.2	91	195.8	366	690	1274	
-196	-320		-45.6	-50	-58.0	-6.67	20	68.0	92	197.6	371	700	1292	
-190	-310		-45.0	-49	-56.2	-6.11	21	69.8	93	199.4	377	710	1310	
-184	-300		-44.4	-48	-54.4	-5.56	22	71.6	94	201.2	382	720	1328	
-179	-290		-43.9	-47	-52.6	-5.00	23	73.4	95	203.0	388	730	1400	
-173	-280		-43.3	-46	-50.9	-4.44	24	75.2	96	204.8	393	740	1418	
-169	-273	-459.4	-42.8	-45	-49.0	-3.89	25	77.0	97	206.6	399	750	1436	
-168	-270	-454	-42.2	-44	-47.2	-3.33	26	78.8	98	208.4	404	760	1400	
-162	-260	-436	-41.7	-43	-45.4	-2.78	27	80.6	99	210.2	410	770	1418	
-157	-250	-418	-41.1	-42	-43.6	-2.22	28	82.4	100	212.0	416	780	1436	
-151	-240	-400	-40.6	-41	-41.8	-1.67	29	84.2	100	TO	10000	421	790	1454
-146	-230	-382	-40.0	-40	-40.0	-1.11	30	86.0	C.	F.	427	800	1472	
-140	-220	-364	-39.4	-39	-38.2	-0.56	31	87.8	38	100	432	810	1490	
-134	-210	-346	-38.9	-38	-36.4	0	32	89.6	43	110	438	820	1508	
-129	-200	-328	-38.3	-37	-34.6	0.56	33	91.4	49	120	443	830	1526	
-123	-190	-310	-37.8	-36	-32.8	1.11	34	93.2	54	130	449	840	1544	
-118	-180	-292	-37.2	-35	-31.0	1.67	35	95.0	60	140	454	850	1582	
-112	-170	-274	-36.7	-34	-29.2	2.22	36	96.8	66	150	460	860	1580	
-107	-160	-256	-36.1	-33	-27.4	2.78	37	98.6	71	160	466	870	1598	
-101	-150	-238	-35.6	-32	-25.6	3.33	38	100.4	77	170	471	880	1616	
-95.6	-140	-220	-35.0	-31	-23.8	3.89	39	102.2	82	180	477	890	1634	
-90.0	-130	-202	-34.4	-30	-22.0	4.44	40	104.0	88	190	482	900	1652	
-84.4	-120	-184	-33.9	-29	-20.2	5.00	41	105.8	93	200	488	910	1670	
-78.9	-110	-166	-33.3	-28	-18.4	5.56	42	107.6	99	210	493	920	1688	
-73.3	-100	-148.0	-32.8	-27	-16.6	6.11	43	109.4	104	220	499	930	1706	
-72.8	-99	-146.2	-32.2	-26	-14.8	6.67	44	111.2	110	230	504	940	1724	
-71.7	-97	-142.6	-31.7	-25	-13.0	7.22	45	113.0	116	240	510	950	1742	
-71.1	-96	-140.8	-31.1	-24	-11.2	7.78	46	114.8	121	250	516	960	1760	
-70.6	-95	-139.0	-30.6	-23	-9.4	8.33	47	116.6	127	260	521	970	1778	
-70.0	-93	-135.4	-30.0	-22	-7.6	8.89	48	118.4	132	270	527	980	1796	
-69.4	-92	-133.6	-29.4	-21	-5.8	9.44	49	120.2	138	280	532	990	1814	
-68.9	-91	-131.8	-28.9	-20	-4.0	10.0	50	122.0	143	290	538	1000	1932	
-68.8	-90	-130.0	-28.8	-19	-2.2	10.6	51	123.8	149	300	544	1000	TO	3000
-67.8	-89	-128.2	-28.2	-18	-0.4	11.1	52	125.6	154	310	550	C.	F.	
-67.2	-88	-126.4	-27.7	-17	1.4	11.7	53	127.4	160	320	556	538	1000	1832
-66.7	-88	-126.4	-27.2	-17	1.4	12.2	54	129.2	166	330	562	593	1100	2012
-66.1	-87	-124.6	-26.7	-16	3.2	12.8	55	131.0	171	340	568	649	1200	2192
-65.6	-86	-122.8	-26.1	-15	5.0	13.3	56	132.8	177	350	574	704	1300	2372
-65.0	-85	-121.0	-25.6	-14	6.8	13.9	57	134.6	182	360	580	760	1400	2552
-64.4	-84	-119.2	-25.0	-13	8.6	14.4	58	136.4	188	370	586	816	1500	2732
-63.9	-83	-117.4	-24.4	-12	10.4	15.0	59	138.2	193	380	592	871	1600	2912
-63.3	-82	-115.6	-23.9	-11	12.2	15.6	60	140.0	199	390	598	927	1700	3092
-62.8	-81	-113.8	-23.3	-10	14.0	16.1	61	141.8	204	400	604	982	1800	3272
-62.2	-80	-112.0	-22.8	-9	15.8	16.7	62	143.6	210	410	610	1038	1900	3452
-61.7	-79	-110.2	-22.2	-8	17.6	17.2	63	145.4	216	420	616	1093	2000	3632
-61.1	-78	-108.4	-21.7	-7	19.4	17.8	64	147.2	221	430	622	1149	2100	3812
-60.6	-77	-106.6	-21.1	-6	21.2	18.3	65	149.0	227	440	628	1204	2200	3992
-60.0	-76	-104.8	-20.6	-5	23.0	18.9	66	150.8	232	450	634	1260	2300	4172
-59.4	-75	-103.0	-20.0	-4	24.8	19.4	67	152.6	238	460	640	1316	2400	4352
-58.9	-74	-101.2	-19.4	-3	26.6	20.0	68	154.4	243	470	646	1371	2500	4532
-58.3	-73	-99.4	-18.7	-2	28.4	20.6	69	156.2	249	480	652	1427	2600	4712
-57.8	-72	-97.6	-18.3	-1	30.2	21.1	70	158.0	254	490	658	1482	2700	4892
-57.2	-71	-95.8	0	TO	100	21.7	71	159.8	260	500	664	1538	2800	5072
-56.7	-70	-94.0	C.	F.		22.2	72	161.6	266	510	670	1593	2900	5252
-56.1	-69	-92.2	-17.8	0	32	22.8	73	163.4	271	520	676	1649	3000	5432
-55.6	-68	-90.4	-17.2	1	33.5	23.3	74	165.2	C.	F.		FOR CONVERSIONS NOT LISTED USE		
-55.0	-67	-88.6	-16.7	2	35.6	23.9	75	167.0	277	530	682			
-54.4	-66	-86.8	-16.1	3	37.4	C.	F.							

## THESE FORMULAS.

$$P_C = \frac{5(P_F - 32)}{9}$$

To convert Fahrenheit to Celsius:  
subtract 32, multiply by 5, divide by 9.

$$P_F = \frac{P_C(9)}{5} + 32$$

To convert Celsius to Fahrenheit:  
multiply by 9, divide by 5, add 32.

# COMPOSITION AND CONDUCTIVITY OF COMMON WAVEGUIDE MATERIALS

Material	Composition (%)						Conductivity
	Cu	Zn	P	Ag	Al	Mg	
Copper (oxygen free)	99.5† min.	-	-	-	-	-	97.6 min.
Copper DLP (deoxidized, low phosphorus)	99.90† min.	-	.0004- 0.012	-	-	-	96.1 min.
Commercial bronze	89-91	9-11	-	-	-	-	44.2 min.
Silver (fine)	0.08 max.	-	-	99.90 min.	-	-	100.0 min.
Coin Silver	9-10.4	0.06	-	89.6-91.0	-	-	82.0 min.
Aluminum 1100	0.2	0.10	-	-	99.0 min.	-	59.9 min.
Aluminum 6061	0.15-0.40	0.25	-	-	95	0.8-1.2	40.0 min.
Magnesium	-	0.05	0.06-1.4	-	2.5-3.5	94.0	37.5‡

\*International Annealed Copper Standard

†Any silver present is counted in the copper content.

‡MIL-HDBK-216, Military Standardization Handbook, "RF Transmission Lines and Fittings."  
4 January 1962

## RECOMMENDED WAVEGUIDE FLANGE TORQUE

Screw Size	Threads per Inch	Recommended Torque (inch-lb)	Tension* (lb)
No.4	40	4.5	235
	80	5.5	280
No.6	32	8.5	360
	40	10	410
No.8	32	18	625
	36	20	685
No.10	24	23	705
	32	32	940
1/4"	20	80	1800
	28	100	2200
5/16"	18	140	2540
	24	150	2620
3/8"	16	250	3740
	24	275	3950
7/16"	14	400	4675
	20	425	4700
1/2"	13	550	6110
	20	575	6140

\*Tension (lb) = torque (inch-lb)/0.2xdiameter of bolt (in.)



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11 Continental Drive, Exeter, NH 03833-4564  
Tel: (603)775-5200 • e-mail: cmt@contmicro.com • fax: (603)775-5201 • URL: www.contmicro.com

## MILLIMETER SIZES

mm	DECIMAL EQUIVALENT	mm	DECIMAL EQUIVALENT	mm	DECIMAL EQUIVALENT	mm	DECIMAL EQUIVALENT
.35mm	.... .0138	2.45mm	.... .0965	5.75mm	.... .2264	9.25 mm	.... .3642
.4 mm	.... .0157	2.5 mm	.... .0984	5.8 mm	.... .2283	9.3 mm	.... .3661
.45mm	.... .0177	2.55mm	.... .1004	5.9 mm	.... .2323	9.4 mm	.... .3701
.5 mm	.... .0197	2.6 mm	.... .1024	6.0 mm	.... .2362	9.5 mm	.... .3740
.55mm	.... .0217	2.65mm	.... .1043	6.1 mm	.... .2401	9.6 mm	.... .3780
.6 mm	.... .0236	2.7 mm	.... .1063	6.2 mm	.... .2441	9.7 mm	.... .3819
.65mm	.... .0256	2.75mm	.... .1083	6.25mm	.... .2461	9.75 mm	.... .3839
.7 mm	.... .0276	2.8 mm	.... .1102	6.3 mm	.... .2480	9.8 mm	.... .3858
.75mm	.... .0295	2.9 mm	.... .1142	6.4 mm	.... .2520	9.9 mm	.... .3898
.8 mm	.... .0315	3.0 mm	.... .1181	6.5 mm	.... .2559	10.0 mm	.... .3937
.85mm	.... .0335	3.1 mm	.... .1220	6.6 mm	.... .2598	10.5 mm	.... .4134
.9 mm	.... .0354	3.2 mm	.... .1260	6.7 mm	.... .2638	11.0 mm	.... .4330
.95mm	.... .0374	3.25mm	.... .1280	6.75mm	.... .2658	11.5 mm	.... .4528
1.0mm	.... .0394	3.3 mm	.... .1299	6.8 mm	.... .2677	12.0 mm	.... .4724
1.05mm	.... .0413	3.4 mm	.... .1339	6.9 mm	.... .2716	12.5 mm	.... .4921
1.1 mm	.... .0433	3.5 mm	.... .1378	7.0 mm	.... .2756	13.0 mm	.... .5118
1.15mm	.... .0453	3.6 mm	.... .1417	7.1 mm	.... .2795	13.5 mm	.... .5315
1.2 mm	.... .0472	3.7 mm	.... .1457	7.2 mm	.... .2835	14.0 mm	.... .5512
1.25mm	.... .0492	3.75mm	.... .1477	7.25mm	.... .2855	14.5 mm	.... .5709
1.3 mm	.... .0512	3.8 mm	.... .1496	7.3 mm	.... .2874	15.0 mm	.... .5906
1.35mm	.... .0531	3.9 mm	.... .1535	7.4 mm	.... .2913	15.5 mm	.... .6102
1.4 mm	.... .0551	4.0 mm	.... .1575	7.5 mm	.... .2953	16.0 mm	.... .6299
1.45mm	.... .0571	4.1 mm	.... .1614	7.6 mm	.... .2992	16.5 mm	.... .6496
1.5 mm	.... .0591	4.2 mm	.... .1654	7.7 mm	.... .3031	17.0 mm	.... .6693
1.55mm	.... .0610	4.25mm	.... .1674	7.75mm	.... .3051	17.5 mm	.... .6890
1.6 mm	.... .0629	4.3 mm	.... .1693	7.8 mm	.... .3071	18.0 mm	.... .7087
1.65mm	.... .0560	4.4 mm	.... .1732	7.9 mm	.... .3110	18.5 mm	.... .7283
1.7 mm	.... .0669	4.5 mm	.... .1771	8.0 mm	.... .3150	19.0 mm	.... .7480
1.75mm	.... .0689	4.6 mm	.... .1811	8.1 mm	.... .3189	19.5 mm	.... .7677
1.8 mm	.... .0709	4.7 mm	.... .1850	8.2 mm	.... .3229	20.0 mm	.... .7874
1.85mm	.... .0728	4.75mm	.... .1870	8.25mm	.... .3248	20.5 mm	.... .8071
1.9 mm	.... .0748	4.8 mm	.... .1890	8.3 mm	.... .3268	21.0 mm	.... .8268
1.95mm	.... .0768	4.9 mm	.... .1929	8.4 mm	.... .3307	21.5 mm	.... .8465
2.0 mm	.... .0787	5.0 mm	.... .1968	8.5 mm	.... .3346	22.0 mm	.... .8661
2.05mm	.... .0807	5.1 mm	.... .2008	8.6 mm	.... .3386	22.5 mm	.... .8858
2.1 mm	.... .0827	5.2 mm	.... .2047	8.7 mm	.... .3425	23.0 mm	.... .9055
2.15mm	.... .0846	5.25mm	.... .2067	8.75mm	.... .3445	23.5 mm	.... .9252
2.2 mm	.... .0866	5.3 mm	.... .2087	8.8 mm	.... .3465	24.0 mm	.... .9449
2.25mm	.... .0886	5.4 mm	.... .2126	8.9 mm	.... .3504	24.5 mm	.... .9646
2.3 mm	.... .0905	5.5 mm	.... .2165	9.0 mm	.... .3543	25.0 mm	.... .9843
2.35mm	.... .0925	5.6 mm	.... .2205	9.1 mm	.... .3583		
2.4 mm	.... .0945	5.7 mm	.... .2244	9.2 mm	.... .3622		



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DS-511

## Fractional, Letter and Number DRILL SIZES/DECIMAL EQUIVALENTS

DRILL SIZE	DECIMAL EQUIVALENT	DRILL SIZE	DECIMAL EQUIVALENT	DRILL SIZE	DECIMAL EQUIVALENT	DRILL SIZE	DECIMAL EQUIVALENT
80	.0135	43	.0890	8	.1990	25/64"	.3906
79	.0145	42	.0935	7	.2010	X	.3970
1/64"	.0156	3/32"	.0938	13/64	.2031	Y	.4040
78	.0161	41	.0960	6	.2040	13/32"	.4062
77	.0180	40	.0980	5	.2055	Z	.4130
76	.0200	39	.0995	4	.2090	27/64"	.4219
75	.0210	38	.1015	3	.2130	7/16"	.4375
74	.0225	37	.1040	7/32"	.2188	29/64"	.4531
73	.0240	36	.1065	2	.2210	15/32"	.4688
72	.0250	7/64"	.1094	1	.2280	31/64"	.4844
71	.0260	35	.1100	A	.2340	1/2"	.5000
70	.0280	34	.1110	15/64"	.2344	33/64"	.5156
69	.0292	33	.1130	B	.2380	17/32"	.5312
68	.0310	32	.1160	C	.2420	35/64"	.5469
1/32"	.0312	31	.1200	D	.2460	9/16"	.5625
67	.0320	1/8"	.1250	1/4"	.2500	37/64"	.5781
66	.0330	30	.1285	F	.2570	19/32"	.5937
65	.0350	29	.1360	G	.2610	39/64"	.6094
64	.0360	28	.1405	17/64"	.2656	5/8"	.6250
63	.0370	9/64"	.1406	H	.2660	41/64"	.6406
62	.0380	27	.1440	I	.2720	21/32"	.6562
61	.0390	26	.1470	J	.2770	43/64"	.6719
60	.0400	25	.1495	K	.2881	11/16"	.6875
59	.0410	24	.1520	9/32"	.2812	45/64"	.7031
58	.0420	23	.1540	L	.2900	23/32"	.7188
57	.0430	5/32"	.1562	M	.2950	47/64"	.7344
56	.0465	22	.1570	19/64"	.2969	3/4"	.7500
3/64"	.0469	21	.1590	N	.3020	49/64"	.7656
55	.0520	20	.1610	5/16"	.3125	25/32"	.7812
54	.0550	19	.1660	O	.3160	51/64"	.7969
53	.0595	18	.1695	P	.3230	13/16"	.8125
1/16"	.0625	11/64"	.1719	21/64"	.3281	53/64"	.8281
52	.0635	17	.1730	Q	.3320	27/32"	.8438
51	.0670	16	.1770	R	.3390	55/64"	.8594
50	.0700	15	.1800	11/32"	.3438	7/8"	.8750
49	.0730	14	.1820	S	.3480	57/64"	.8906
48	.0760	13	.1850	T	.3580	29/32"	.9062
5/64"	.0781	3/16"	.1875	23/64"	.3594	59/64"	.9219
47	.0785	12	.1890	U	.3680	15/16"	.9375
46	.0810	11	.1910	3/8"	.3750	61/64"	.9531
45	.0820	10	.1935	V	.3770	31/32"	.9688
44	.0860	9	.1960	W	.3860	63/64"	.9844
						1	.0000



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# MACHINE-SCREW DIMENSIONS AND OTHER DATA

Screw No.	Thread/in.		Clearance Drill*		Tap Drill † Diameter		Round		Head Flat		Fillister		Hex Nut		Washer				
	Diam	Coarse	Fine	No.	Diam	No.	Inches	mm	Max OD	Max Height	Max OD	Max Height	Across Flat	Across Corner	Thick- ness	Thick- ness	OD	ID	
0	0.0600	-	80	52	0.064	56	0.046	1.2	0.113	0.053	0.119	0.096	0.059	0.156	0.171	0.046	-	-	-
1	0.073	64	72	47	0.079	53	0.060	1.5	0.138	0.061	0.146	0.118	0.070	0.156	0.171	0.046	-	-	-
2	0.086	56	64	42	0.094	50	0.070	1.8	0.162	0.070	0.172	0.140	0.083	0.187	0.205	0.062	1/4	0.093	0.032
3	0.099	48	-	37	0.104	47	0.079	2.0	0.187	0.078	0.199	0.161	0.095	0.187	0.205	0.062	1/4	0.105	0.020
		-	56	45	0.082	45	0.082	2.1											
4	0.112	40	-	31	0.120	43	0.080	2.3	0.211	0.086	0.225	0.183	0.107	0.250	0.275	0.093	5/16	0.125	0.032
		-	48	42	0.094	42	0.094	2.4											
5	0.125	40	-	29	0.136	38	0.102	2.6	0.236	0.095	0.252	0.205	0.120	0.312	0.344	0.109	3/8	0.140	0.032
		-	44	37	0.104	37	0.104	2.6											
6	0.138	32	-	27	0.144	36	0.107	2.7	0.260	0.103	0.279	0.226	0.132	0.312	0.344	0.109	5/16	0.156	0.026
		-	40	33	0.113	33	0.113	2.9											
8	0.164	32	-	18	0.170	29	0.136	3.5	0.309	0.119	0.332	0.270	0.156	0.344	0.373	0.125	3/8	0.186	0.032
		-	36	29	0.136	29	0.136	3.5											
10	0.190	24	-	9	0.196	25	0.150	3.8	0.359	0.136	0.385	0.313	0.180	0.375	0.413	0.125	7/16	0.218	0.036
		-	32	21	0.159	21	0.159	4.0											
12	0.216	24	-	2	0.221	16	0.177	4.5	0.408	0.152	0.438	0.357	0.205	0.437	0.488	0.156	1/2	0.250	0.063
		-	28	14	0.182	14	0.182	4.6											
1/4	0.250	20	-	7	0.201	7	0.201	5.1	0.472	0.174	0.507	0.414	0.237	0.437	0.488	0.203	9/16	0.281	0.040
		-	28	3	0.213	3	0.213	5.5						0.500	0.5777	.250	5/8	0.281	0.063


All dimensions in inches except where noted.

\*Clearance-drill sizes are practical values for use of the engineer or technician doing his own shop work.

†Tap drill sizes are for use in hand tapping material such as brass or soft steel. For copper, aluminum, Norway iron, cast iron, bakelite, or for very thin material, the drill should be a size or two larger in diameter than shown.

DESIGN AIDS

DS-513

 **Continental Microwave & Tool Company, Inc.**  
**A Chelton Microwave Company**

11 Continental Drive, Exeter, NH 03833-4564  
 Tel: (603)775-5200 • e-mail: cnt@contmicro.com • fax: (603)775-5201 • URL: www.contmicro.com

DESIGN AIDS

# C.M.T. MATERIAL & PROCESS STANDARDS

## ROD, BAR, TUBE, AND SHEET STOCK METAL

MATERIAL	SPECIFICATION
Aluminum Alloy 5052	QQ-A-250/8
Aluminum Alloy 6061 or Alloy 6063	QQ-A-250/11
Beryllium Copper, Alloy 25 (Sheet, Strip)	QQ-C-530
Beryllium Copper, Alloy C17200 (Flex Tubing)	ASTM B194-88
Brass, Alloy 360	QQ-B-613
Copper, Phosphor Bronze	QQ-B-750
Copper, O.F.H.C.	QQ-C-502
Steel, Carbon, Structural	QQ-S-741
Steel, Spring, Chromium Nickel Alloy	MIL-S-46889
Steel, CRES, Stainless	MIL-S-4043
Steel, Medium to High Carbon	QQ-S-700
Steel, CRES, (Plate, Sheet, and Strip)	QQ-S-766
Steel, Carbon, Alloy, High Strength	MIL-S-13281

## CASTINGS

MATERIAL	SPECIFICATION
Aluminum, investment, Alloy 40E/71A	QQ-A-596
Aluminum, investment, Alloy A356	QQ-A-596
Copper, investment	QQ-C-390
Steel, investment, CRES	MIL-S-81591

## WAVEGUIDE

W/G TYPE	SPECIFICATION
Rigid, Rectangular	MIL-W-85
Rigid, Double-Ridge	MIL-W-23351
Flanges, Rectangular	MIL-F-3922
Flanges, Double-Ridge	MIL-F-39000
Flex Seamless, Rectangular	MIL-W-287/4
Flex Seamless, Double-Ridge	MIL-S-287/7

## MISCELLANEOUS MATERIALS AND SUPPLIES

MATERIAL	SPECIFICATION
RFE Fluorocarbon	MIL-P-19468
Polyimide Sheet and Strip	MIL-P-46112
Boron Nitride	MIL-B-47208
Silicon Carbide	MIL-S-47156
Silicone Adhesive/Sealant	MIL-A-46106
Adhesive, Epoxy ResinBase	MIL-A-47284
Adhesive, Epoxy, Silver Filled, Conductive	MIL-A-1931
R.F. Connectors	MIL-C-39012

## CONTRACT SERVICE

PROCESS	SPECIFICATION
Copper Plating	MIL-C-14550/Class 2
Electroless Nickel	MIL-C-26074/Class 1
Silver Plating	QQ-S-365/Type 1/Grade A
Solder Plate	MIL-F-14072
Rhodium	MIL-R-46085/Type 1
Tin Plate	MIL-T-10727/Type 1
Cadmium	QQ-P-416/Type II
Gold Plating	MIL-G-45204/Type II/Class 2

## CMT PROCESS STANDARDS

PROCESS	SPECIFICATION
Welding, Brazing Support	MIL-W-6858
Aluminum Dip Brazing	MIL-B-007883 V
Torch Brazing	MIL-B-007883 I
Torch Soldering	QQ-S-571
Chem Film, Aluminum, Iridite	MIL-C-5541
Chem Film, Brass/Copper Iridite	n/a
Rubber Coating and Molding	MIL-R-47211
Heat Treatment, Aluminum	MIL-H-6088
Heat Treatment, Flex, Beryllium Copper	MIL-H-7199
Impregnation	MIL-STD-276
Paint & Finish	FED-STD-595
Polysulfide Coating	MIL-S-8802

## DESIGN AIDS




**Continental Microwave & Tool Company, Inc.**  
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# CONVERSION OF POWER (DBM TO WATTS)

POWER DBM	POWER MICROWATTS	POWER DBM	POWER MILLIWATTS	POWER DBM	POWER MILLIWATTS	POWER DBM	POWER MILLIWATTS	POWER DBM	POWER WATTS
-60	.001	-30	.001	0	1	30	1		
-59	.00126	-29	.00126	1	1.2589	31	1.2589		
-58	.00158	-28	.00158	2	1.5849	32	1.5849		
-57	.00200	-27	.00200	3	1.9953	33	1.9953		
-56	.00251	-26	.00251	4	2.5119	34	2.5119		
-55	.00316	-25	.00316	5	3.1623	35	3.1623		
-54	.00398	-24	.00398	6	3.9811	36	3.9811		
-53	.00501	-23	.00501	7	5.0119	37	5.0119		
-52	.00631	-22	.00631	8	6.3096	38	6.3096		
-51	.00794	-21	.00794	9	7.9433	39	7.9433		
-50	.01	-20	.01	10	10	40	10		
-49	.01259	-19	.01259	11	12.589	41	12.589		
-48	.01585	-18	.01585	12	15.849	42	15.849		
-47	.01995	-17	.01995	13	19.953	43	19.953		
-46	.02512	-16	.02512	14	25.119	44	25.119		
-45	.03162	-15	.03162	15	31.623	45	31.623		
-44	.03981	-14	.03981	16	39.811	46	39.811		
-43	.05012	-13	.05012	17	50.119	47	50.119		
-42	.06310	-12	.06310	18	63.096	48	63.096		
-41	.07943	-11	.07943	19	79.433	49	79.433		
-40	.1	-10	.1	20	100	50	100		
-39	.12589	-9	.12589	21	125.89	51	125.89		
-38	.15849	-8	.15849	22	158.49	52	158.49		
-37	.19953	-7	.19953	23	199.53	53	199.53		
-36	.25119	-6	.25119	24	251.19	54	251.19		
-35	.31623	-5	.31623	25	316.23	55	316.23		
-34	.39811	-4	.39811	26	398.11	56	398.11		
-33	.50119	-3	.50119	27	501.19	57	501.19		
-32	.63096	-2	.63096	28	630.96	58	630.96		
-31	.79433	-1	.79433	29	794.33	59	794.33		
-30	1	0	1	30	1000	60	1000		

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# CONVERSION OF POWER (WATTS TO DBM)

POWER MICROWATTS	POWER DBM	POWER MILLIWATTS	POWER DBM	POWER MILLIWATTS	POWER DBM	POWER MILLIWATTS	POWER DBM	POWER WATTS	POWER DBM
.001	-60	.001	-30	1	0	1	30	1	30
.002	-56.99	.002	-26.99	2	3.0103	2	33.010	2	33.010
.003	-55.23	.003	-25.23	3	4.7712	3	34.771	3	34.771
.004	53.98	.004	-23.98	4	6.0206	4	36.021	4	36.021
.005	-53.01	.005	-23.01	5	6.9897	5	36.990	5	36.990
.006	-52.22	.006	-22.22	6	7.7815	6	37.782	6	37.782
.007	-51.55	.007	-21.55	7	8.4510	7	38.451	7	38.451
.008	-50.97	.008	-20.97	8	9.0309	8	39.031	8	39.031
.009	-50.46	.009	-20.46	9	9.5424	9	39.542	9	39.542
.01	-50	.01	-20	10	10	10	40	10	40
.02	-46.99	.02	-16.99	20	13.010	20	43.010	20	43.010
.03	-45.23	.03	-15.23	30	14.771	30	44.771	30	44.771
.04	-43.98	.04	-13.98	40	16.021	40	46.021	40	46.021
.05	-43.01	.05	-13.01	50	16.990	50	46.990	50	46.990
.06	-42.22	.06	-12.22	60	17.782	60	47.782	60	47.782
.07	-41.55	.07	-11.55	70	18.451	70	48.451	70	48.451
.08	-40.97	.08	-10.97	80	19.031	80	49.031	80	49.031
.09	-40.46	.09	-10.46	90	19.542	90	49.542	90	49.542
.1	-40	.1	-10	100	20	100	50	100	50
.2	-36.99	.2	-6.990	200	23.010	200	53.010	200	53.010
.3	-35.23	.3	-5.229	300	24.771	300	54.771	300	54.771
.4	-33.98	.4	-3.979	400	26.021	400	56.021	400	56.021
.5	-33.01	.5	-3.010	500	26.990	500	56.990	500	56.990
.6	-32.22	.6	-2.218	600	27.782	600	57.782	600	57.782
.7	-31.55	.7	-1.549	700	28.451	700	58.451	700	58.451
.8	-30.97	.8	-.9691	800	29.031	800	59.031	800	59.031
.9	-30.46	.9	-.4576	900	29.542	900	59.542	900	59.542
1	-30	1	0	1000	30	1000	60	1000	60



# CONVERSION OF DB TO POWER RATIO

GIVEN: Decibels

TO FIND: Power and  $\left\{ \begin{matrix} \text{Voltage} \\ \text{Current} \end{matrix} \right\}$  Ratios

TO ACCOUNT FOR THE SIGN OF THE DECIBEL

For positive (+) values of the decibel – Both voltage and power ratios are greater than unity. Use the two right-hand columns.

For negative (-) values of the decibel – Both voltage and power ratios are less than unity. Use the two left-hand columns.

Example – Given:  $\pm 9.1$  dB Find:

	Power Ratio	Voltage Ratio
+ 9.1 dB	8.128	2.851
- 9.1 dB	0.1230	0.3508

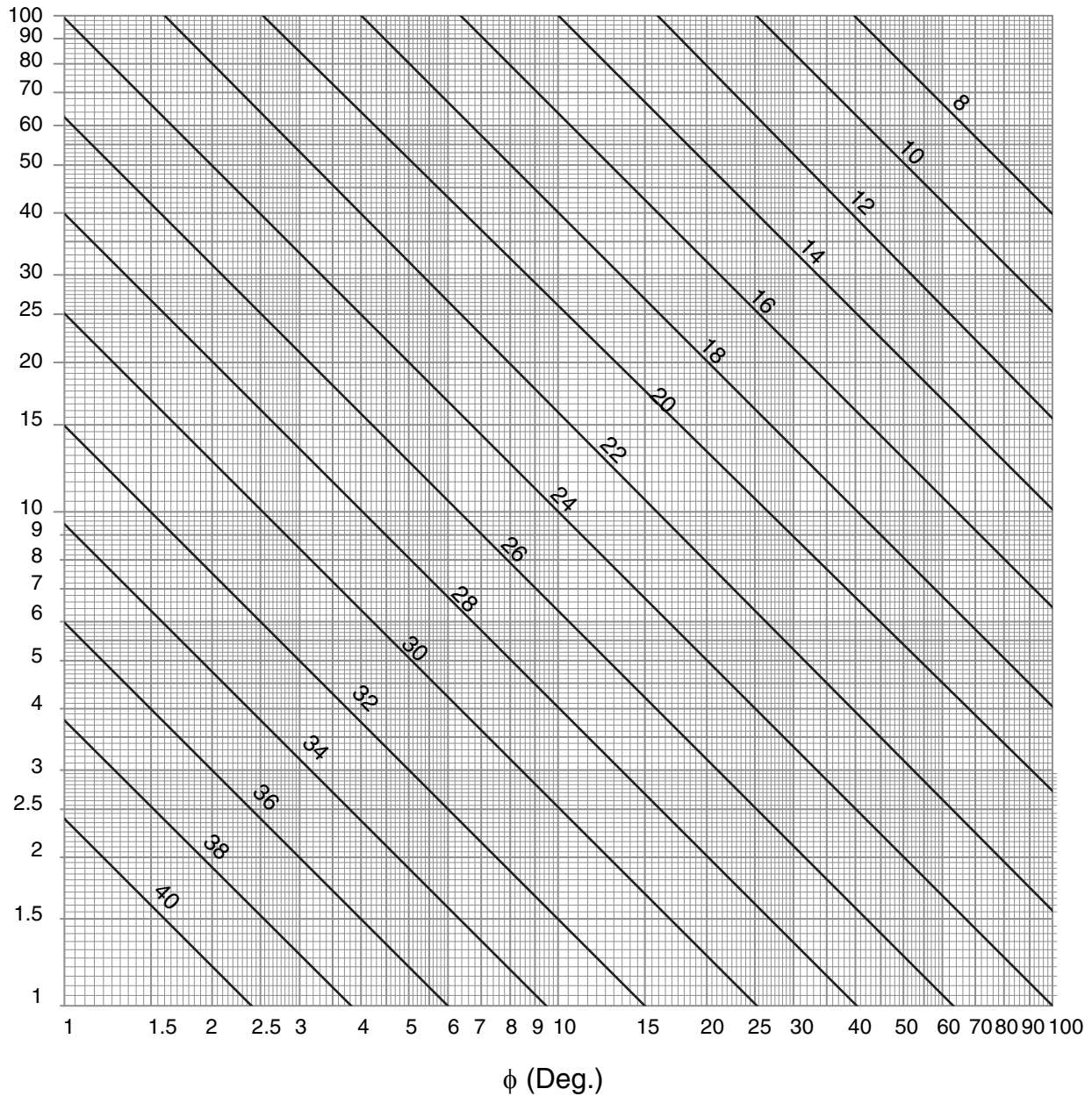
← -dB+ →					← -dB+ →					← -dB+ →				
Voltage Ratio	Power Ratio	dB	Voltage Ratio	Power Ratio	Voltage Ratio	Power Ratio	dB	Voltage Ratio	Power Ratio	Voltage Ratio	Power Ratio	dB	Voltage Ratio	Power Ratio
1.0000	1.0000	0	1.000	1.000	.4217	.1778	7.5	2.371	5.623	.1778	.03162	15.0	5.623	31.62
.9886	.9772	.1	1.012	1.023	.4169	.1738	7.6	2.399	5.754	.1758	.03090	15.1	5.689	32.36
.9772	.9550	.2	1.023	1.047	.4121	.1698	7.7	2.427	5.888	.1738	.03020	15.2	5.754	33.11
.9661	.9333	.3	1.035	1.072	.4074	.1660	7.8	2.455	6.026	.1718	.02951	15.3	5.821	33.88
.9550	.9120	.4	1.047	1.096	.4027	.1622	7.9	2.483	6.166	.1698	.02884	15.4	5.888	34.67
.9441	.8913	.5	1.059	1.122	.3981	.1585	8.0	2.512	6.310	.1679	.02818	15.5	5.957	35.48
.9333	.8710	.6	1.072	1.148	.3936	.1549	8.1	2.541	6.457	.1660	.02754	15.6	6.026	36.31
.9226	.8511	.7	1.084	1.175	.3890	.1514	8.2	2.570	6.607	.1641	.02692	15.7	6.095	37.15
.9120	.8318	.8	1.096	1.202	.3846	.1479	8.3	2.600	6.761	.1622	.02630	15.8	6.166	38.02
.9016	.8128	.9	1.109	1.230	.3802	.1445	8.4	2.630	6.918	.1603	.02570	15.9	6.237	38.90
.8913	.7943	1.0	1.22	1.259	.3758	.1413	8.5	2.661	7.079	.1585	.02512	16.0	6.310	39.81
.8810	.7762	1.1	1.135	1.288	.3715	.1380	8.6	2.692	7.244	.1567	.02455	16.1	6.383	40.74
.8710	.7586	1.2	1.148	1.318	.3673	.1349	8.7	2.723	7.413	.1549	.02399	16.2	6.457	41.69
.8610	.7413	1.3	1.161	1.349	.3631	.1318	8.8	2.754	7.586	.1531	.02344	16.3	6.531	42.66
.8511	.7244	1.4	1.175	1.380	.3589	.1288	8.9	2.786	7.762	.1514	.02291	16.4	6.607	43.65
.8414	.7079	1.5	1.189	1.413	.3548	.1259	9.0	2.818	7.943	.1496	.02239	16.5	6.683	44.67
.8318	.6918	1.6	1.202	1.445	.3508	.1230	9.1	2.851	8.128	.1479	.02188	16.6	6.761	45.71
.8222	.6761	1.7	1.216	1.479	.3467	.1202	9.2	2.884	8.318	.1462	.02138	16.7	6.839	46.77
.8128	.6607	1.8	1.230	1.514	.3428	.1175	9.3	2.917	8.511	.1445	.02089	16.8	6.918	47.86
.8035	.6457	1.9	1.245	1.549	.3388	.1148	9.4	2.951	8.710	.1429	.02042	16.9	6.998	48.98
.7943	.6310	2.0	1.259	1.585	.3350	.1122	9.5	2.985	8.913	.1413	.01995	17.0	7.079	50.12
.7852	.6166	2.1	1.274	1.622	.3311	.1096	9.6	3.020	9.120	.1396	.01950	17.1	7.161	51.29
.7762	.6026	2.2	1.288	1.660	.3273	.1072	9.7	3.055	9.333	.1380	.01905	17.2	7.244	52.48
.7674	.5888	2.3	1.303	1.698	.3236	.1047	9.8	3.090	9.550	.1365	.01862	17.3	7.328	53.70
.7586	.5754	2.4	1.318	1.738	.3199	.1023	9.9	3.126	9.772	.1349	.01820	17.4	7.413	54.95
.7499	.5623	2.5	1.334	1.778	.3162	.1000	10.0	3.162	10.000	.1334	.01778	17.5	7.499	56.23
.7413	.5495	2.6	1.349	1.820	.3126	.09772	10.1	3.199	10.23	.1318	.01738	17.6	7.586	57.54
.7328	.5370	2.7	1.365	1.862	.3090	.09550	10.2	3.236	10.47	.1303	.01698	17.7	7.674	58.88
.7244	.5248	2.8	1.380	1.905	.3055	.09333	10.3	3.273	10.72	.1288	.01660	17.8	7.762	60.26
.7161	.5129	2.9	1.396	1.950	.3020	.09120	10.4	3.311	10.96	.1274	.01622	17.9	7.852	61.66
.7079	.5012	3.0	1.413	1.995	.2985	.08913	10.5	3.350	11.22	.1259	.01585	18.0	7.943	63.10
.6998	.4898	3.1	1.429	2.042	.2951	.08710	10.6	3.388	11.48	.1245	.01549	18.1	8.035	64.57
.6918	.4786	3.2	1.445	2.089	.2917	.08511	10.7	3.428	11.75	.1230	.01514	18.2	8.128	66.07
.6839	.4677	3.3	1.462	2.138	.2884	.08318	10.8	3.467	12.02	.1216	.01479	18.3	8.222	67.61
.6761	.4571	3.4	1.479	2.188	.2851	.08128	10.9	3.508	12.30	.1202	.01445	18.4	8.318	69.18
.6683	.4467	3.5	1.496	2.239	.2818	.07943	11.0	3.548	12.59	.1189	.01413	18.5	8.414	70.79
.6607	.4365	3.6	1.514	2.291	.2786	.07762	11.1	3.589	12.88	.1175	.01380	18.6	8.511	72.44
.6531	.4266	3.7	1.531	2.344	.2754	.07586	11.2	3.631	13.18	.1161	.01349	18.7	8.610	74.13
.6457	.4169	3.8	1.549	2.399	.2723	.07413	11.3	3.673	13.49	.1148	.01318	18.8	8.710	75.86
.6383	.4074	3.9	1.567	2.455	.2692	.07244	11.4	3.715	13.80	.1135	.01288	18.9	8.811	77.62
.6310	.3981	4.0	1.585	2.512	.2661	.07079	11.5	3.758	14.13	.1122	.01259	19.0	8.913	79.43
.6237	.3890	4.1	1.603	2.570	.2630	.06918	11.6	3.802	14.45	.1109	.01230	19.1	9.016	81.28
.6166	.3802	4.2	1.622	2.630	.2600	.06761	11.7	3.846	14.79	.1096	.01202	19.2	9.120	83.18
.6095	.3715	4.3	1.641	2.692	.2570	.06607	11.8	3.890	15.14	.1084	.01175	19.3	9.226	85.11
.6026	.3631	4.4	1.660	2.754	.2541	.06457	11.9	3.936	15.49	.1072	.01148	19.4	9.333	87.10
.5957	.3548	4.5	1.679	2.818	.2512	.06310	12.0	3.981	15.85	.1059	.01122	19.5	9.441	89.13
.5888	.3467	4.6	1.698	2.884	.2483	.06166	12.1	4.027	16.22	.1047	.01096	19.6	9.550	91.20
.5821	.3388	4.7	1.718	2.951	.2455	.06026	12.2	4.074	16.60	.1035	.01072	19.7	9.661	93.33
.5754	.3311	4.8	1.738	3.020	.2427	.05888	12.3	4.121	16.98	.1023	.01047	19.8	9.772	95.50
.5689	.3236	4.9	1.758	3.090	.2399	.05754	12.4	4.169	17.38	.1012	.01023	19.9	9.886	97.72
.5623	.3162	5.0	1.778	3.162	.2371	.05623	12.5	4.217	17.78	.1000	.01000	20.0	10.000	100.00
.5559	.3090	5.1	1.799	3.236	.2344	.05495	12.6	4.266	18.20	.0989	.00989			
.5495	.3020	5.2	1.820	3.311	.2317	.05370	12.7	4.315	18.62	.0979	.00979			
.5433	.2951	5.3	1.841	3.388	.2291	.05248	12.8	4.365	19.05	.0969	.00969			
.5370	.2884	5.4	1.862	3.467	.2265	.05129	12.9	4.416	19.50	.0959	.00959			
.5309	.2818	5.5	1.884	3.548	.2239	.05012	13.0	4.467	19.95	.0949	.00949			
.5248	.2754	5.6	1.905	3.631	.2213	.04898	13.1	4.519	20.42	.0939	.00939			
.5188	.2692	5.7	1.928	3.715	.2188	.04786	13.2	4.571	20.89	.0929	.00929			
.5129	.2630	5.8	1.950	3.802	.2163	.04677	13.3	4.624	21.38	.0919	.00919			
.5070	.2570	5.9	1.972	3.890	.2138	.04571	13.4	4.677	21.88	.0909	.00909			
.5012	.2512	6.0	1.995	3.981	.2113	.04467	13.5	4.732	22.39	.0899	.00899			
.4955	.2455	6.1	2.018	4.074	.2089	.04365	13.6	4.786	22.91	.0889	.00889			
.4898	.2399	6.2	2.042	4.169	.2065	.04266	13.7	4.842	23.44	.0879	.00879			
.4842	.2344	6.3	2.065	4.266	.2042	.04169	13.8	4.898	23.99	.0869	.00869			
.4786	.2291	6.4	2.089	4.365	.2018	.04074	13.9	4.955	24.55	.0859	.00859			
.4732	.2239	6.5	2.113	4.467	.1995	.03981	14.0	5.012	25.12	.0849	.00849			
.4677	.2188	6.6	2.138	4.571	.1972	.03890	14.1	5.070	25.70	.0839	.00839			
.4624	.2138	6.7	2.163	4.677	.1950	.03802	14.2	5.129	26.30	.0829	.00829			
.4571	.2089	6.8	2.188	4.786	.1928	.03715	14.3	5.188	26.92	.0819	.00819			
.4519	.2042	6.9	2.213	4.898	.1905	.03631	14.4	5.248	27.54	.0809	.00809			
.4467	.1995	7.0	2.239	5.012	.1884	.03548	14.5	5.309	28.18	.0799	.00799			
.4416	.1959	7.1	2.265	5.129	.1862	.03467	14.6	5.370	28.84	.0789	.00789			
.4365	.1905	7.2	2.291	5.248	.1841	.03388	14.7	5.433	29.51	.0779	.00779			
.4315	.1862	7.3	2.317	5.370	.1820	.03311	14.8	5.495	30.20	.0769	.00769			
.4266	.1820	7.4	2.344	5.495	.1799	.03236	14.9	5.559	30.90	.0759	.00759			

← -dB+ →

Voltage Ratio	Power Ratio	dB	Voltage Ratio	Power Ratio
$3.162 \times 10^{-1}$	$10^{-1}$	10	$3.162 \times 10^{-1}$	$10^{-1}$
$3.162 \times 10^{-2}$	$10^{-2}$	20	$3.162 \times 10^{-2}$	$10^{-2}$
$3.162 \times 10^{-3}$	$10^{-3}$	30	$3.162 \times 10^{-3}$	$10^{-3}$
$3.162 \times 10^{-4}$	$10^{-4}$	40	$3.162 \times 10^{-4}$	$10^{-4}$
$3.162 \times 10^{-5}$	$10^{-5}$	50	$3.162 \times 10^{-5}$	$10^{-5}$
$3.162 \times 10^{-6}$	$10^{-6}$	60	$3.162 \times 10^{-6}$	$10^{-6}$
$3.162 \times 10^{-7}$	$10^{-7}$	70	$3.162 \times 10^{-7}$	$10^{-7}$
$3.162 \times 10^{-8}$	$10^{-8}$	80	$3.162 \times 10^{-8}$	$10^{-8}$
$3.162 \times 10^{-9}$	$10^{-9}$	90	$3.162 \times 10^{-9}$	$10^{-9}$
$3.162 \times 10^{-10}$	$10^{-10}$	100	$3.162 \times 10^{-10}$	$10^{-10}$

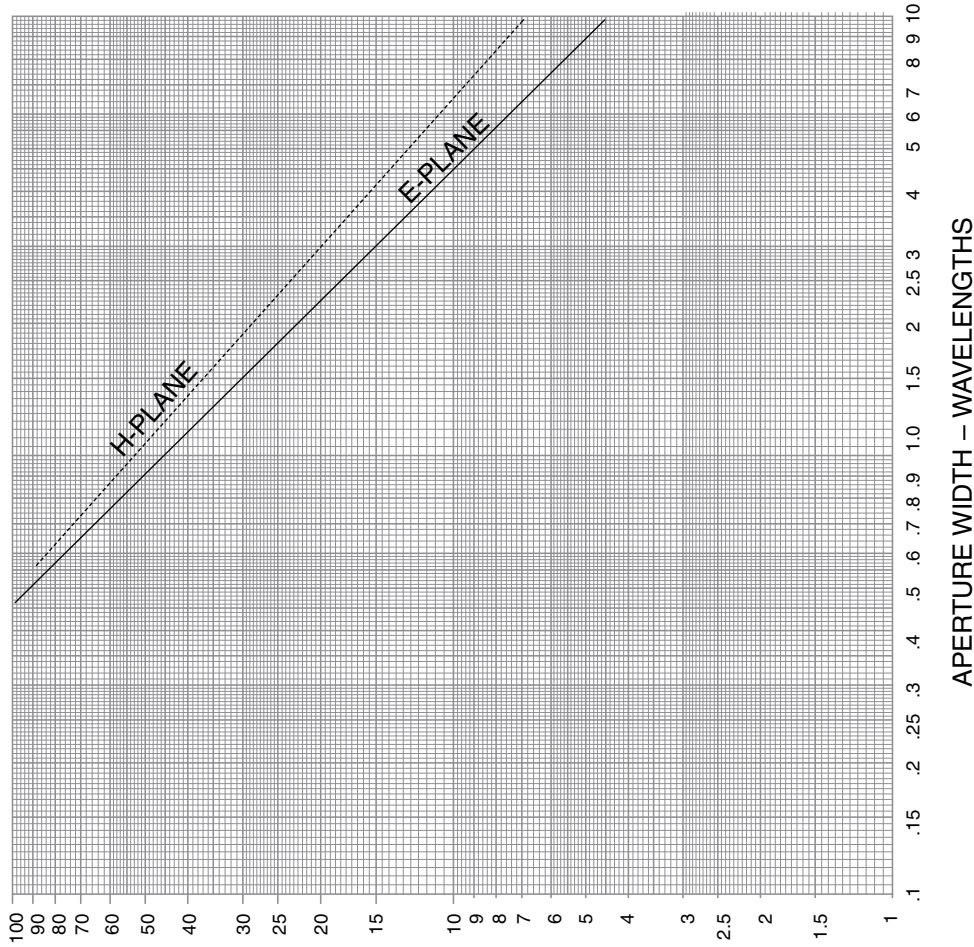
## LINEAR HORN GAIN vs H.P.B.W. (APPROXIMATION)

$$D = \frac{27000}{\phi (\phi)}$$

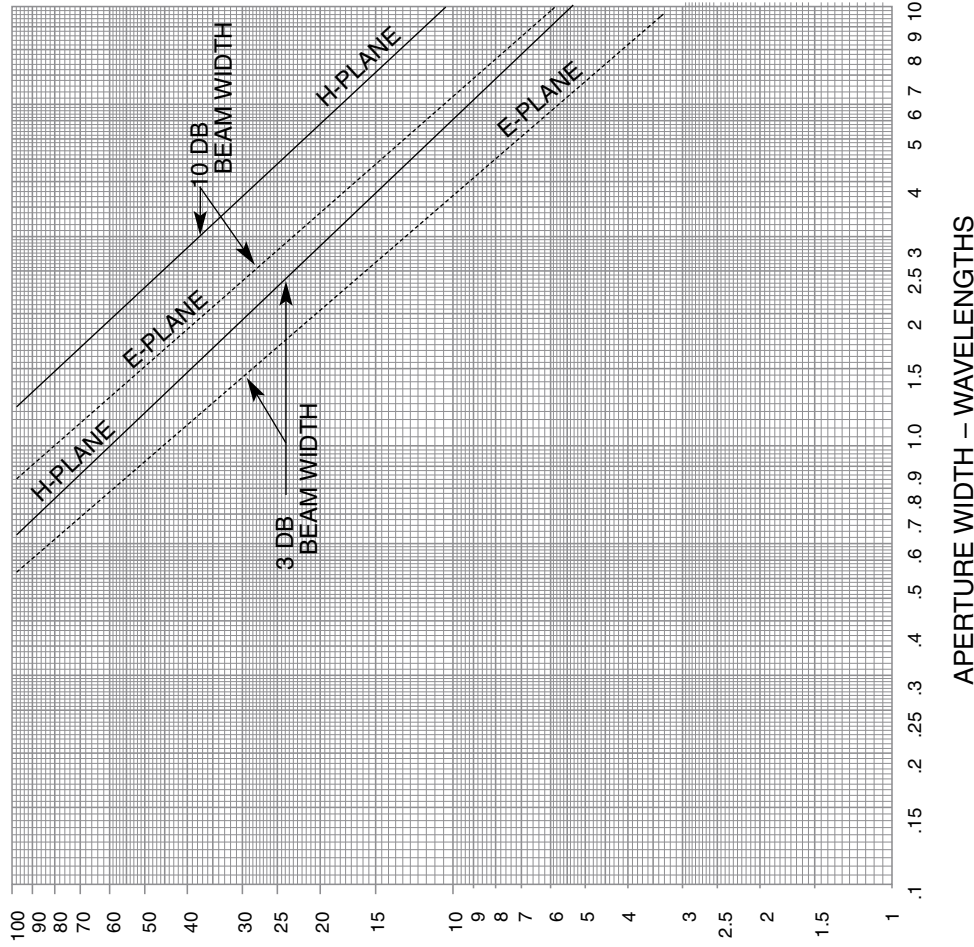


# LINEAR HORN H.P.B.W. vs APERTURE WIDTH

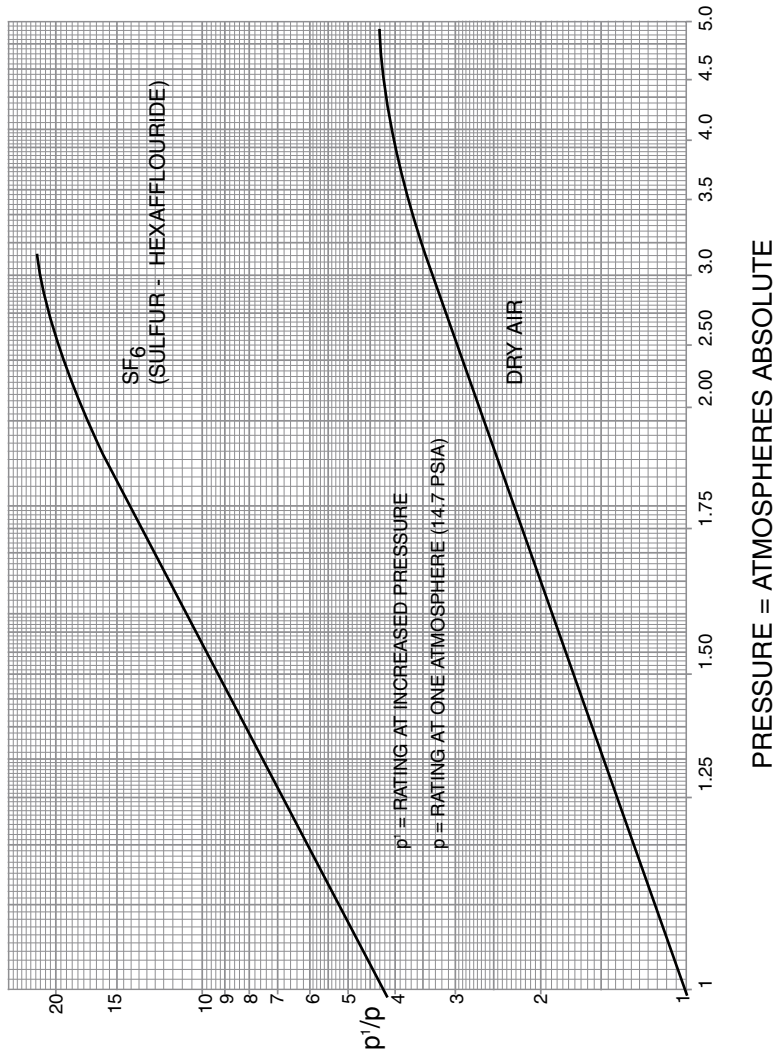
**CASE 1**  
OPEN WAVEGUIDE OR FLAT GAIN DESIGN



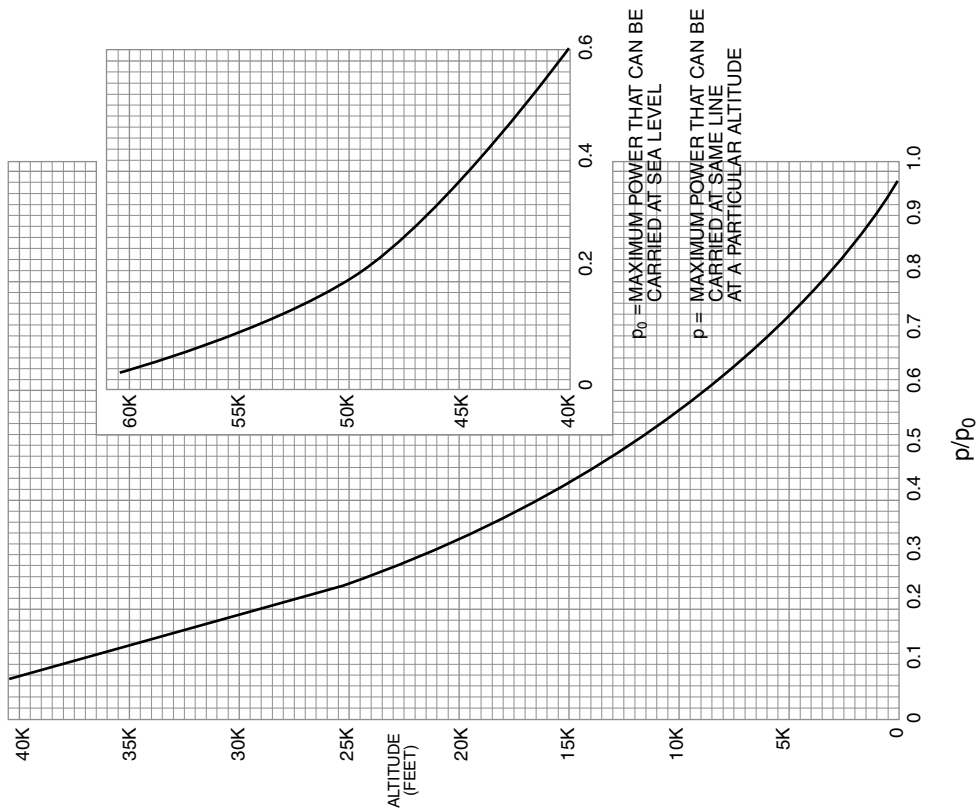
**CASE 2**  
OPTIMUM GAIN DESIGN



**PEAK POWER vs. WAVEGUIDE PRESSURE**



**ALTITUDE DE-RATING CURVE**



# PRESSURE AND TEMPERATURE VALUES FOR VARIOUS ALTITUDES

Based on U.S. Standard Atmosphere						From N.A.C.A. Report No. 538					
ALTITUDE (Feet)	PRESSURE			TEMPERATURE		ALTITUDE (Feet)	PRESSURE			TEMPERATURE	
	in Hg	mm Hg	P.S.I.	°C	°F		in Hg	mm Hg	P.S.I.	°C	°F
-1,000	31.02	787.9	15.25	17.0	62.6	32,500	7.91	201.0	3.89	-49.4	-56.9
-500	30.47	773.8	14.94	16.0	60.8	33,000	7.73	196.4	3.80	-50.4	-58.7
0	29.921	760.0	14.70	15.0	59.0	33,500	7.55	191.8	3.71	-51.4	-60.5
500	29.38	746.4	14.43	14.0	57.2	34,000	7.38	187.4	3.63	-52.4	-62.3
1,000	28.86	732.9	14.18	13.0	55.4	34,500	7.20	183.0	3.54	-53.4	-64.1
1,500	28.33	719.7	13.90	12.0	53.6	35,000	7.04	178.7	3.46	-54.3	-65.8
2,000	27.82	706.6	13.67	11.0	51.8	35,332	6.93	175.9	3.40	-55.0	-66.0
2,500	27.31	693.8	13.41	10.0	50.0	35,500	6.87	174.5	3.375	-55.0	-66.0
3,000	26.81	681.1	13.19	9.1	48.4	36,000	6.71	170.4	3.296	-55.0	-66.0
3,500	26.32	668.6	12.92	8.1	46.6	36,500	6.55	158.6	3.22	-55.0	-66.0
4,000	25.84	656.3	12.70	7.1	44.8	37,000	6.39	162.4	3.14	-55.0	-66.0
4,500	25.36	644.2	12.45	6.1	43.0	37,500	6.24	158.6	3.067	-55.0	-66.0
5,000	24.89	632.3	12.23	5.1	41.2	38,000	6.10	154.9	2.994	-55.0	-66.0
5,500	24.43	620.6	12.00	4.1	39.4	38,500	5.95	151.2	2.925	-55.0	-66.0
6,000	23.98	609.0	11.77	3.1	37.6	39,000	5.81	147.6	2.852	-55.0	-66.0
6,500	23.53	597.6	11.56	2.1	35.8	39,500	5.68	144.1	2.798	-55.0	-66.0
7,000	23.09	586.4	11.34	1.1	34.0	40,000	5.54	140.7	2.72	-55.0	-66.0
7,500	22.65	575.3	11.12	0.1	32.2	40,500	5.41	137.4	2.66	-55.0	-66.0
8,000	22.22	564.4	10.90	-0.8	30.67	41,000	5.28	134.2	2.595	-55.0	-66.0
8,500	21.80	553.7	10.70	-1.8	28.8	41,500	5.16	131.0	2.535	-55.0	-66.0
9,000	21.38	543.2	10.50	-2.8	27.0	42,000	5.04	127.9	2.47	-55.0	-66.0
9,500	20.98	532.8	10.30	-3.8	25.2	42,500	4.92	124.9	2.415	-55.0	-66.0
10,000	20.58	522.6	10.10	-4.8	23.4	43,000	4.80	122.0	2.36	-55.0	-66.0
10,500	20.18	512.5	9.91	-5.8	21.6	43,500	4.69	119.1	2.304	-55.0	-66.0
11,000	19.79	502.6	9.73	-6.8	19.8	44,000	4.58	116.3	2.25	-55.0	-66.0
11,500	19.40	492.8	9.53	-7.8	18.0	44,500	4.47	113.5	2.195	-55.0	-66.0
12,000	19.03	483.3	9.35	-8.8	16.2	45,000	4.36	110.8	2.14	-55.0	-66.0
12,500	18.65	473.8	9.15	-9.8	14.4	45,500	4.26	108.2	2.094	-55.0	-66.0
13,000	18.29	464.5	8.97	-10.8	12.6	46,000	4.16	105.7	2.042	-55.0	-66.0
13,500	17.93	455.4	8.81	-11.7	10.9	46,500	4.06	103.2	1.997	-55.0	-66.0
14,000	17.57	446.4	8.63	-12.7	9.1	47,000	3.97	100.7	1.948	-55.0	-66.0
14,500	17.22	437.5	8.46	-13.7	7.3	47,500	3.873	98.38	1.90	-55.0	-66.0
15,000	16.88	428.8	8.28	-14.7	5.5	48,000	3.781	96.05	1.858	-55.0	-66.0
15,500	16.54	420.2	8.13	-15.7	3.7	48,500	3.693	93.79	1.813	-55.0	-66.0
16,000	16.21	411.8	7.96	-16.7	1.9	49,000	3.605	91.57	1.772	-55.0	-66.0
16,500	15.89	403.5	7.81	-17.7	0.1	49,500	3.52	89.41	1.729	-55.0	-66.0
17,000	15.56	395.3	7.64	-18.7	-1.7	50,000	3.436	87.30	1.689	-55.0	-66.0
17,500	15.25	387.3	7.49	-19.7	-3.5	51,000	3.276	83.22	1.610	-55.0	-66.0
18,000	14.94	379.4	7.34	-20.7	-5.3	52,000	3.124	79.34	1.533	-55.0	-66.0
18,500	14.63	371.7	7.19	-21.7	-7.1	53,000	2.978	75.64	1.463	-55.0	-66.0
19,000	14.33	364.0	7.04	-22.6	-8.7	54,000	2.839	72.12	1.395	-55.0	-66.0
19,500	14.04	356.5	6.90	-23.6	-10.5	55,000	2.707	68.76	1.33	-55.0	-66.0
20,000	13.75	349.1	6.75	-24.6	-12.3	56,000	2.581	65.55	1.269	-55.0	-66.0
20,500	13.46	341.9	6.61	-25.6	-14.1	57,000	2.460	62.49	1.208	-55.0	-66.0
21,000	13.18	334.7	6.48	-26.6	-15.9	58,000	2.346	59.58	1.152	-55.0	-66.0
21,500	12.90	327.7	6.34	-27.6	-17.7	59,000	2.236	56.80	1.098	-55.0	-66.0
22,000	12.63	320.8	6.21	-28.6	-19.5	60,000	2.132	54.15	1.048	-55.0	-66.0
22,500	12.36	314.1	6.08	-29.6	-21.3	61,000	2.033	51.63	1.000	-55.0	-66.0
23,000	12.10	307.4	5.94	-30.6	-23.1	62,000	1.938	49.22	0.952	-55.0	-66.0
23,500	11.84	300.9	5.82	-31.6	-24.9	63,000	1.847	46.92	0.906	-55.0	-66.0
24,000	11.59	294.4	5.70	-32.5	-26.5	64,000	1.761	44.73	0.865	-55.0	-66.0
24,500	11.34	288.1	5.58	-33.5	-28.3	65,000	1.679	42.65	0.825	-55.0	-66.0
25,000	11.10	281.9	5.45	-34.5	-30.1	66,000	1.601	40.66	0.786	-55.0	-66.0
25,500	10.86	275.8	5.33	-35.5	-31.9	67,000	1.526	38.76	0.748	-55.0	-66.0
26,000	10.62	269.8	5.22	-36.5	-33.7	68,000	1.455	36.95	0.714	-55.0	-66.0
26,500	10.39	263.9	5.11	-37.5	-35.5	69,000	1.387	35.23	0.681	-55.0	-66.0
27,000	10.16	258.1	4.99	-38.5	-37.3	70,000	1.322	33.59	0.649	-55.0	-66.0
27,500	9.94	252.5	4.88	-39.5	-39.1	71,000	1.261	32.02	0.619	-55.0	-66.0
28,000	9.72	246.9	4.78	-40.5	-40.9	72,000	1.202	30.53	0.590	-55.0	-66.0
28,500	9.50	241.4	4.67	-41.5	-42.7	73,000	1.146	29.10	0.562	-55.0	-66.0
29,000	9.29	236.0	4.56	-42.5	-44.5	74,000	1.093	27.75	0.536	-55.0	-66.0
29,500	9.08	230.7	4.46	-43.4	-46.1	75,000	1.041	26.45	0.512	-55.0	-66.0
30,000	8.88	225.6	4.36	-44.4	-47.9	76,000	0.993	25.22	0.488	-55.0	-66.0
30,500	8.68	220.5	4.27	-45.4	-49.7	77,000	0.946	24.04	0.465	-55.0	-66.0
31,000	8.48	215.5	4.17	-46.4	-51.5	78,000	0.902	22.92	0.443	-55.0	-66.0
31,500	8.29	210.6	4.07	-47.4	-53.3	79,000	0.860	21.85	0.423	-55.0	-66.0
32,000	8.10	205.8	3.98	-48.4	-55.1	80,000	0.820	20.83	0.403	-55.0	-66.0

# PRESSURE CONVERSIONS

ABSOLUTE PRESSURE									GAGE PRESSURE (2)	
cm of Hg	Torr or mm of Hg	Micron	Atmosphere	lb/in <sup>2</sup>	ton/ft <sup>2</sup>	gram/cm <sup>2</sup>	ft of H <sub>2</sub> O	in of Hg	lb/in <sup>2</sup>	in of Hg
76	760	760000	1.0	14.70	1.06	1033	33.9	29.9	0	0
70	700	700000	.921	13.53	.975	952	31.2	27.6	1.16	2.36
60	600	600000	.790	11.60	.835	816	26.8	23.6	3.10	6.30
50	500	500000	.659	9.67	.696	680	22.3	19.7	5.03	10.2
40	400	400000	.526	7.74	.557	545	17.8	15.7	6.97	14.2
30	300	300000	.395	5.80	.417	408	13.4	11.8	8.90	18.1
20	200	200000	.263	3.87	.278	272	8.92	7.87	10.8	22.0
10	100	100000	.132	1.94	.139	136	4.46	3.94	12.8	26.0
5	50	50000	.066	.967	.070	68.0	2.23	1.97	13.7	27.9
1	10	10000	.013	.194	.014	13.6	.446	.394	14.5	29.5
0.1	1	1000	.001	.019	.001	1.36	.045	.039	14.68	29.88
0	0	0	0	0	0	0	0	0	14.70	29.92

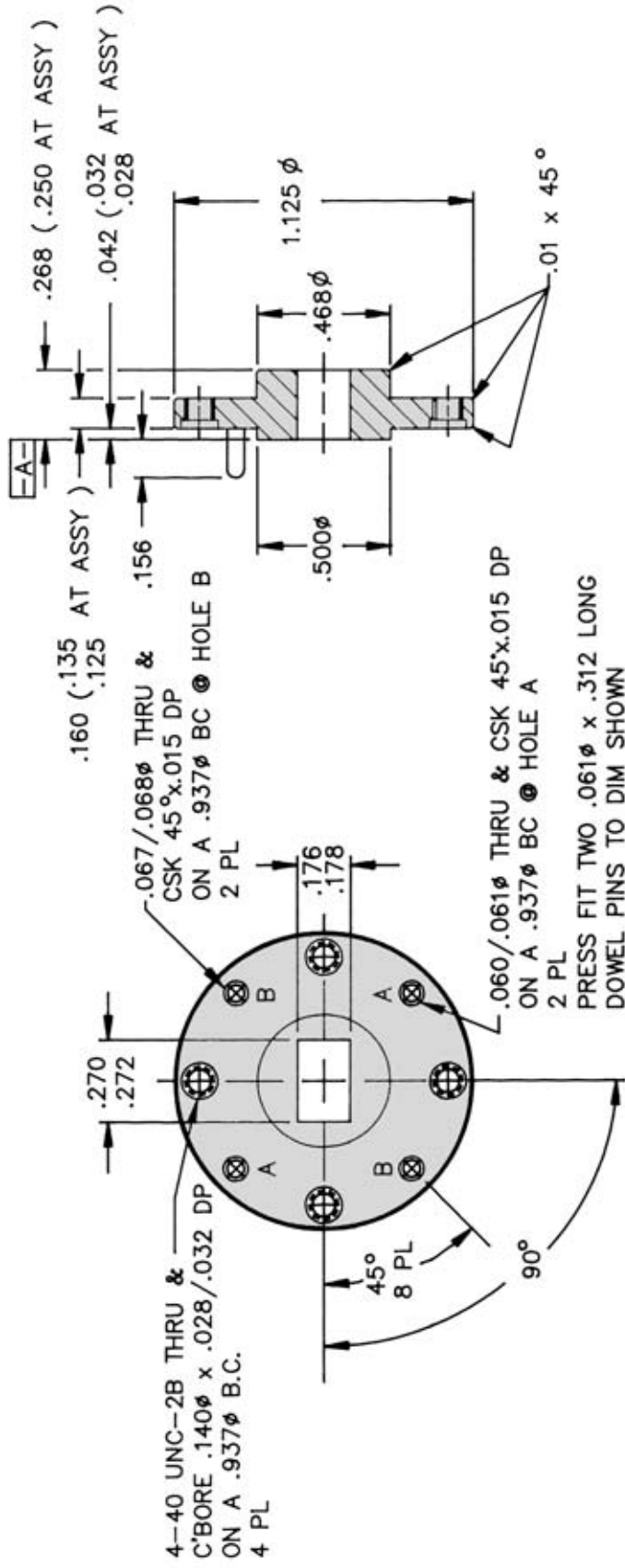
(1) Positive pressure measured from absolute zero.

(2) Negative pressure (or vacuum) measured from atmospheric pressure.

## PRESSURE EQUIVALENTS

Millitorr, or Micron	Torr or mm of Hg	
1000	= 1.0	= 10 <sup>0</sup>
100	= 0.1	= 10 <sup>1</sup>
10	= 0.01	= 10 <sup>2</sup>
1.0	= 0.001	= 10 <sup>3</sup>
0.5	= 0.0005	= 5 x 10 <sup>-4</sup>
0.1	= 0.0001	= 1 x 10 <sup>-4</sup> x or 10 <sup>-4</sup>
0.01	= 0.00001	= 10 <sup>-5</sup>
0.001	= 0.000001	= 10 <sup>-6</sup>

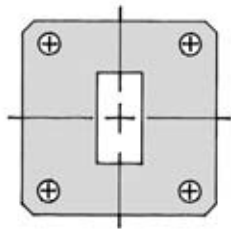
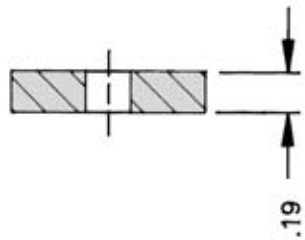
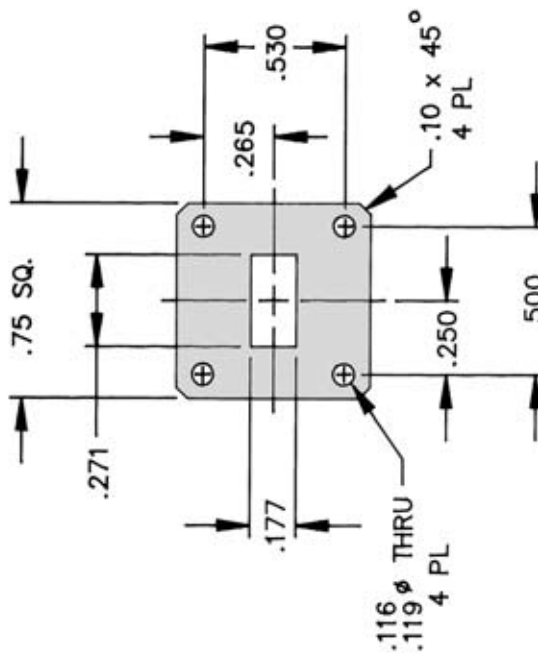




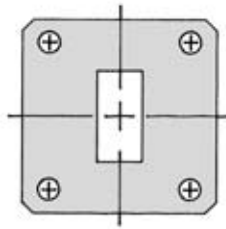
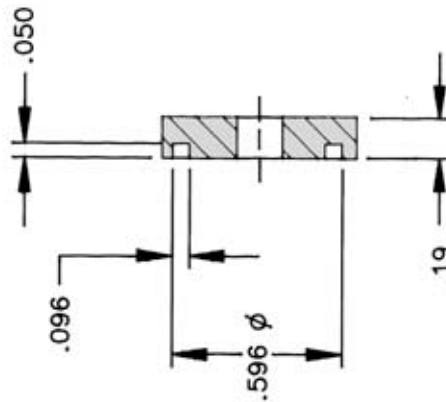
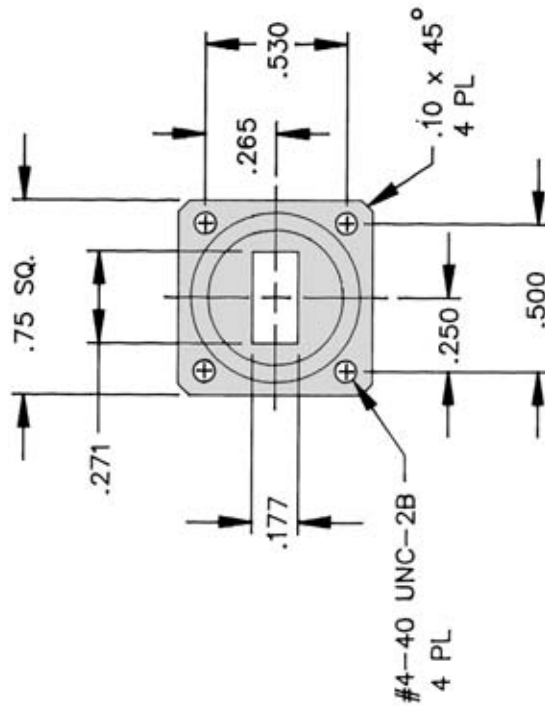
# FLANGE COVER

WR 19 (bES-24)



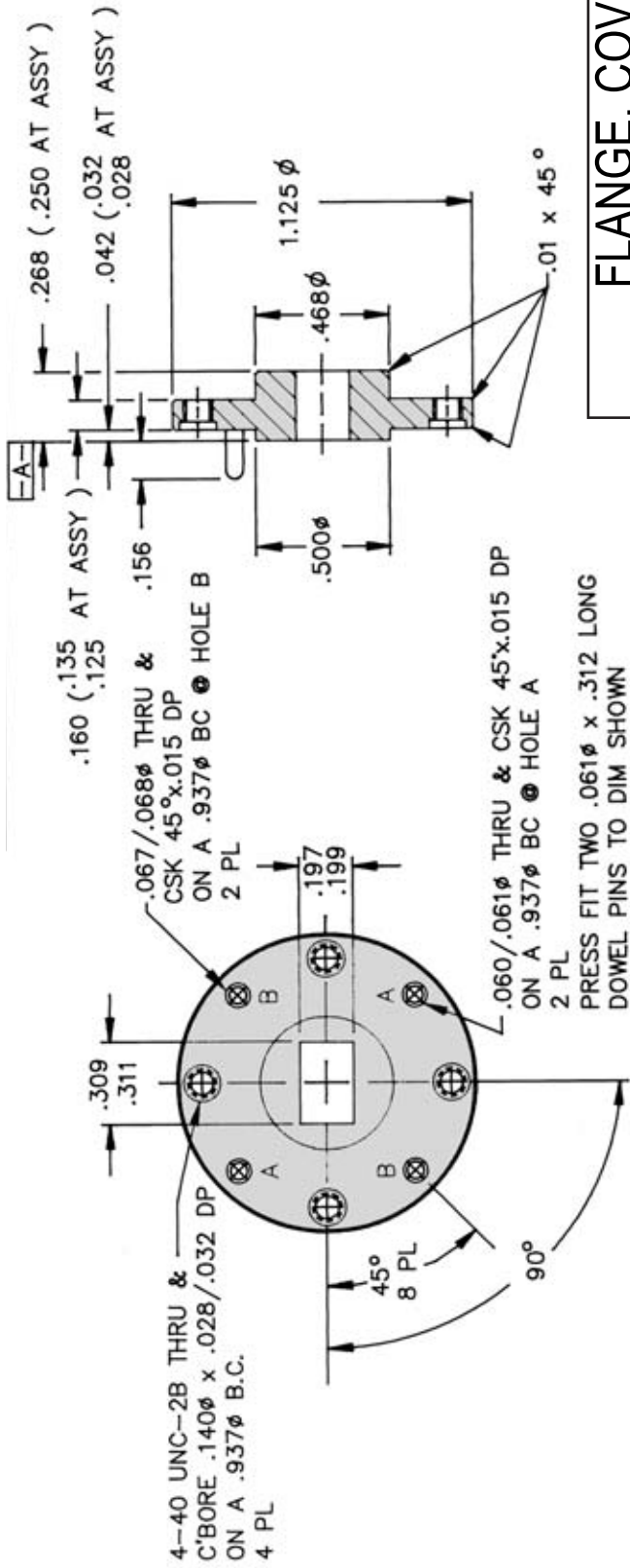


**FLANGE COVER**  
WR 19 (DES-1)



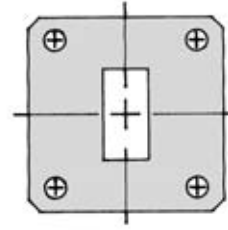
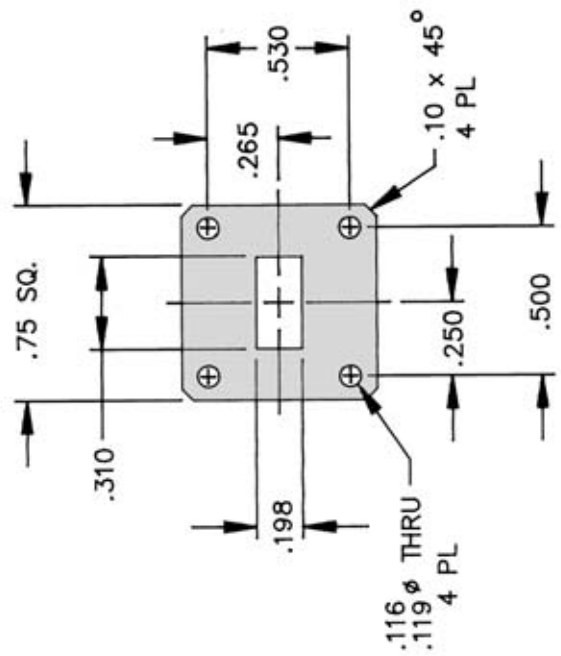
Continental Microwave & Tool Company, Inc.  
A Chelton Microwave Company  
1 Continental Drive, Borer, WI 53453-0509  
Tel: (608) 775-8200, e: cmt@continentalmco.com, fax: (608) 775-8201, URL: www.continentalmco.com

**FLANGE, GROOVED**  
WR 19 (DES-8)



# FLANGE COVER

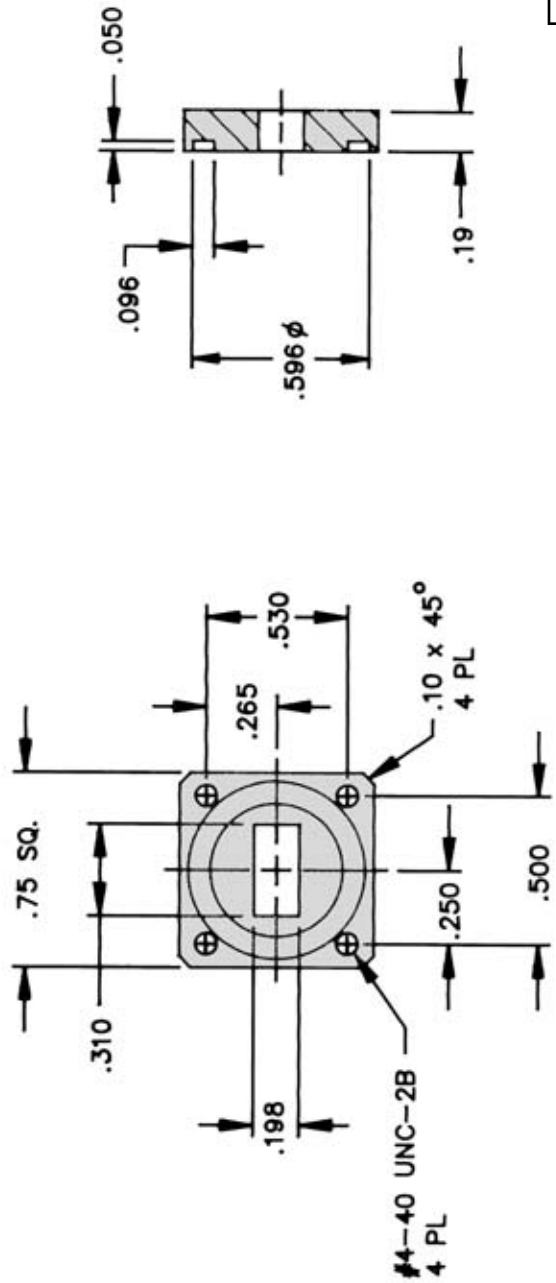
WR 22 (DES-24)



Continental Microwave & Tool Company, Inc.  
 A Chelton Microwave Company  
 1 Continental Drive, Bower, NH 03343-0507  
 Tel: (603) 753-8300, e: cmt@continentalmco.com, fax: (603) 753-8321, URL: www.continmco.com

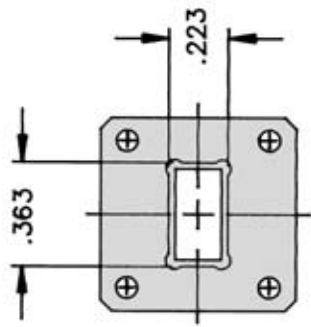
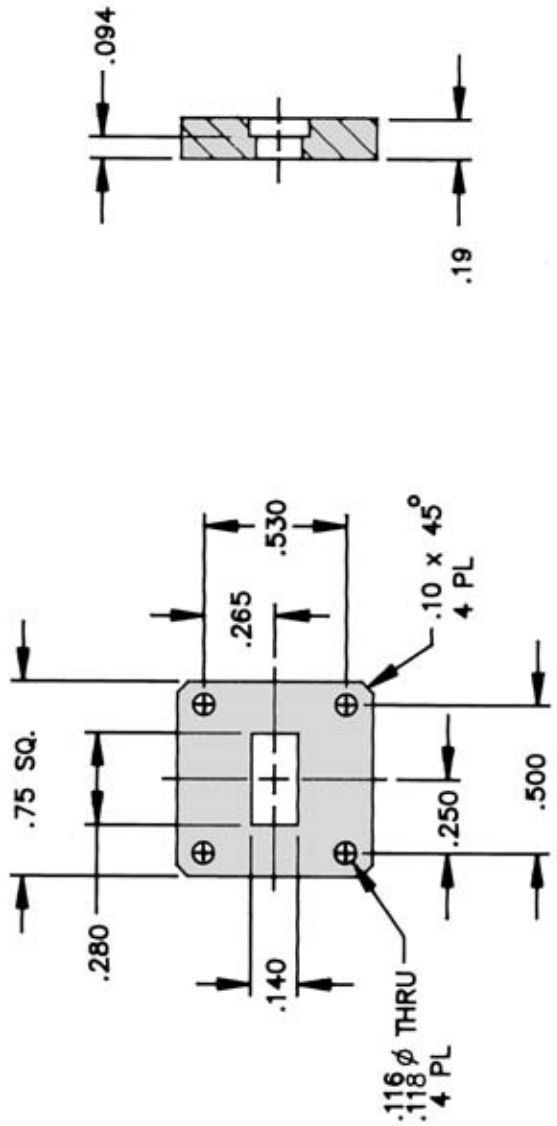
# FLANGE COVER

WR 22 (DES-1)



# FLANGE, GROOVED

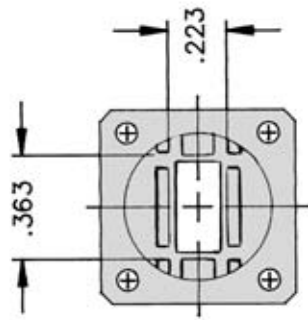
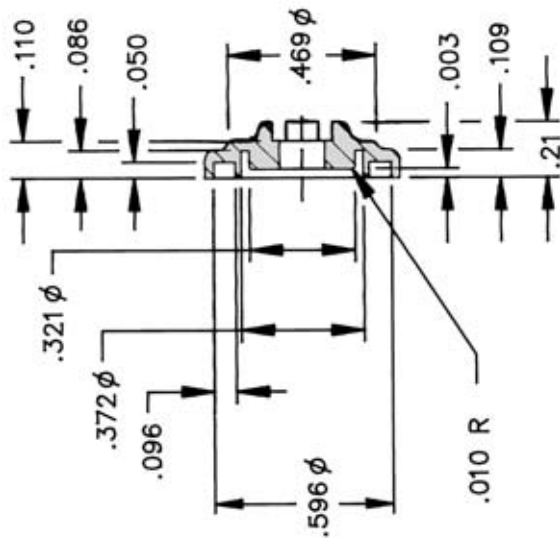
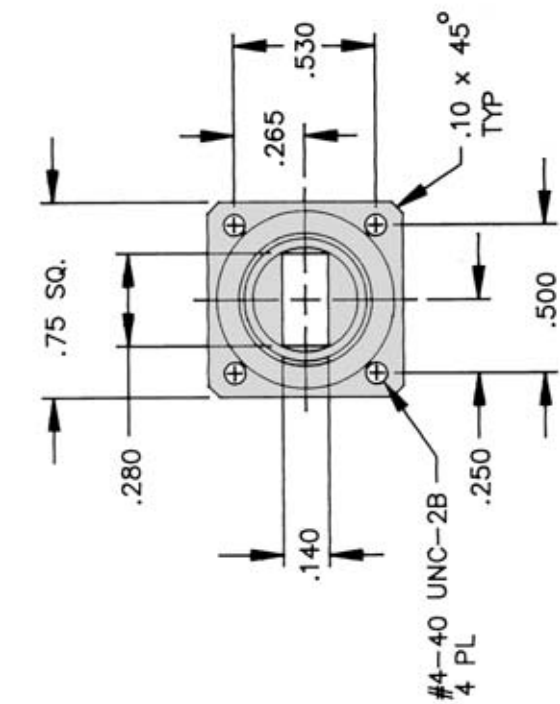
WR 22 (DES-8)



Continental Microwave & Tool Company, Inc.  
 A Chelton Microwave Company  
 1 Continental Drive, Brierley, WI 53153-2606  
 Tel: (608) 775-9200, e: cmt@continentalmicrowave.com, fax: (608) 775-9211, URL: www.continentalmic.com

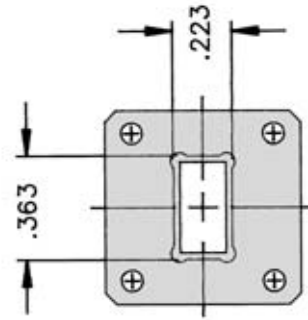
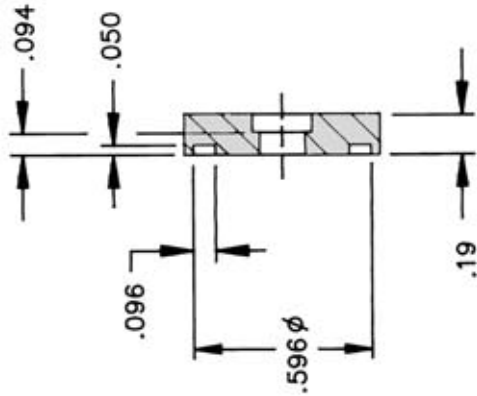
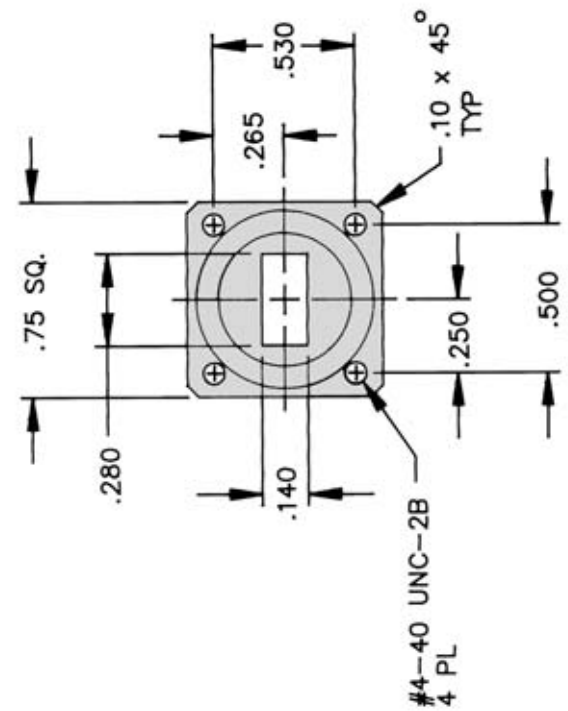
# FLANGE COVER

WR 28 (DES-1)



## FLANGE CHOKE

WR 28 (DES-5)

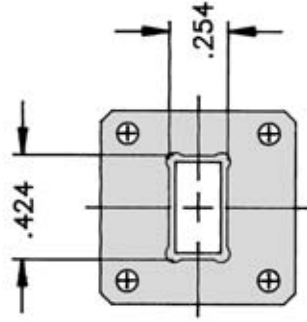
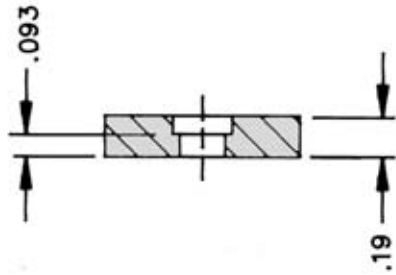
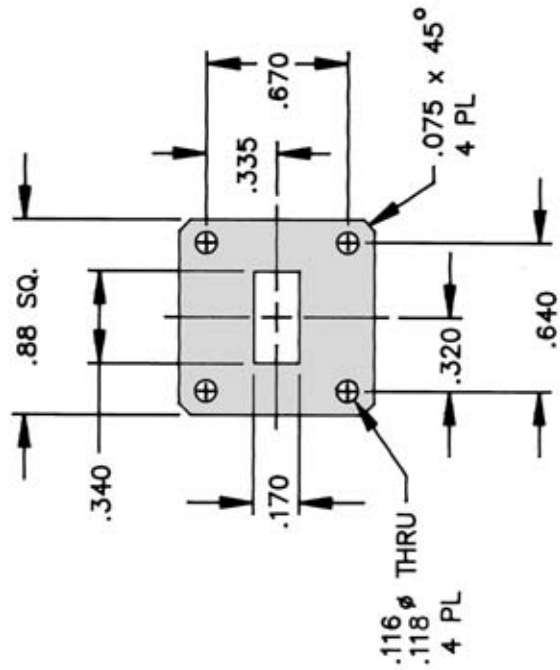


Continental Microwave & Tool Company, Inc.  
— A Chelton Microwave Company

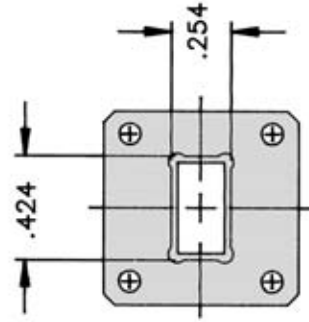
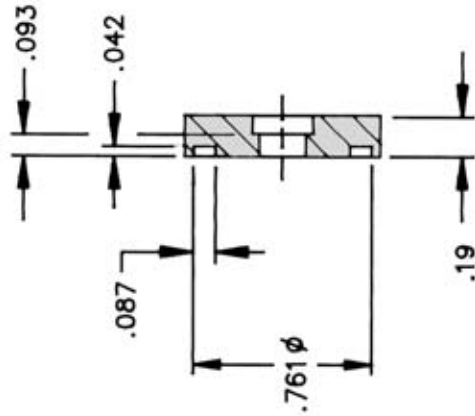
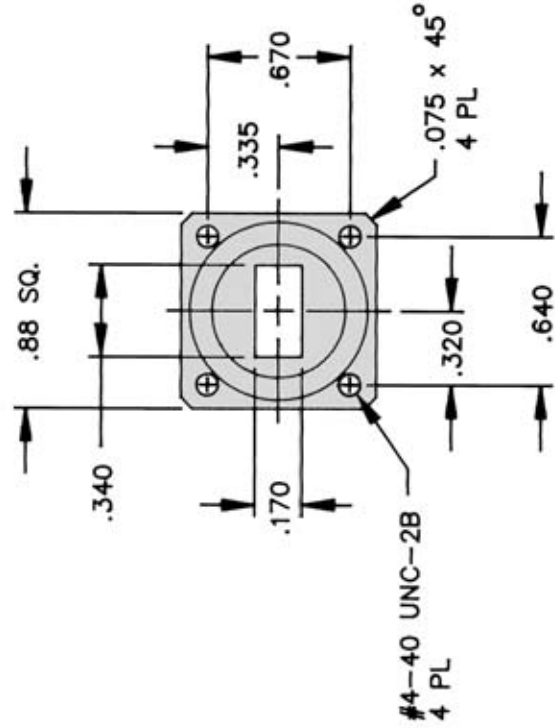
11 Continental Drive, Bunker Hill, MA 01930-1306  
Tel: (603) 775-8200, e: cmail@continentalmco.com, fax: (603) 775-8211, URL: www.continentalmco.com

## FLANGE, GROOVED

WR 28 (DES-8)

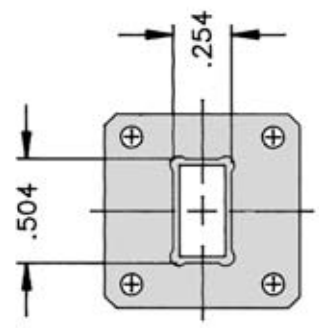
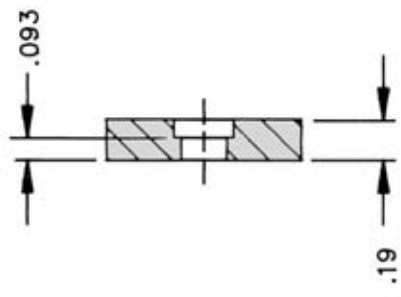
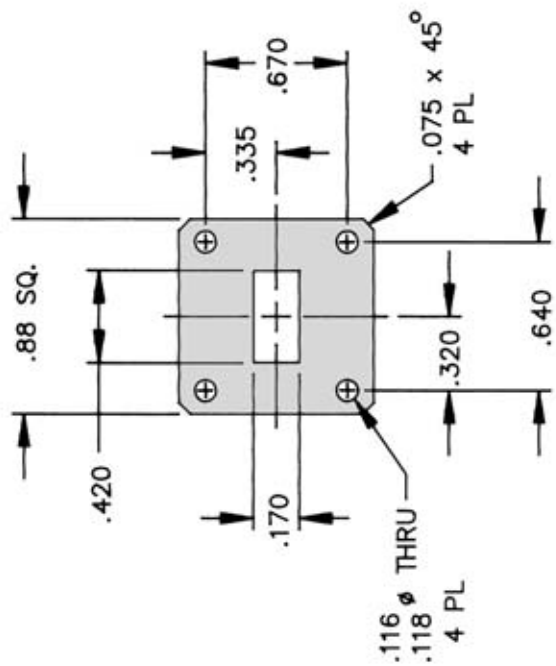


## FLANGE COVER WR 34 (DES-1)



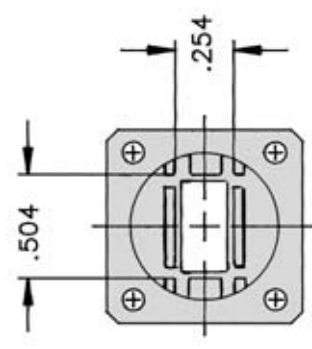
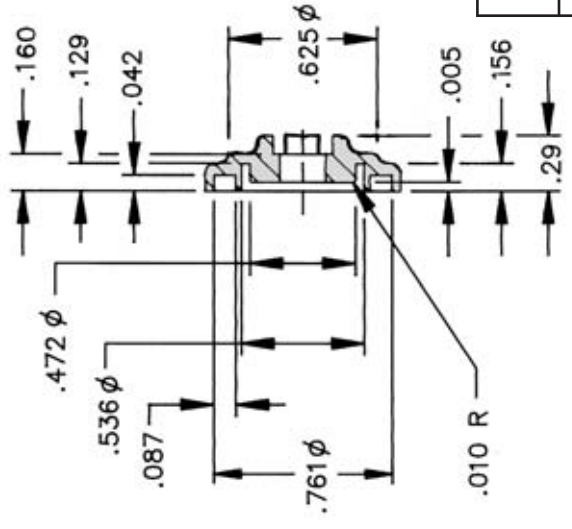
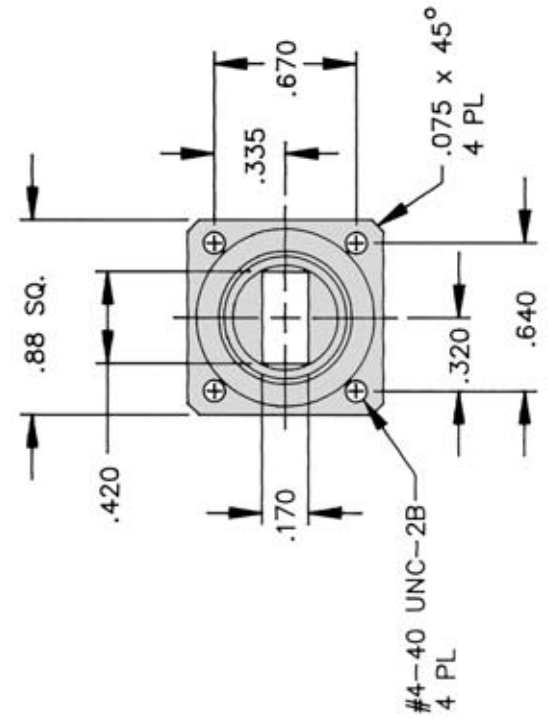
Continental Microwave & Tool Company, Inc.  
A Chelton Microwave Company  
1 Continental Drive, Brierley, WI 53153-0509  
Tel: (608) 775-8200, e: cmt@continentalmicrowave.com, fax: (608) 775-8201, URL: www.continentalmicrowave.com

## FLANGE, GROOVED WR 34 (DES-8)



# FLANGE COVER

WR 42 (DES-1)



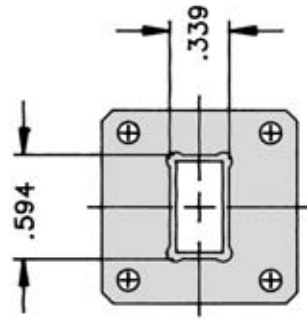
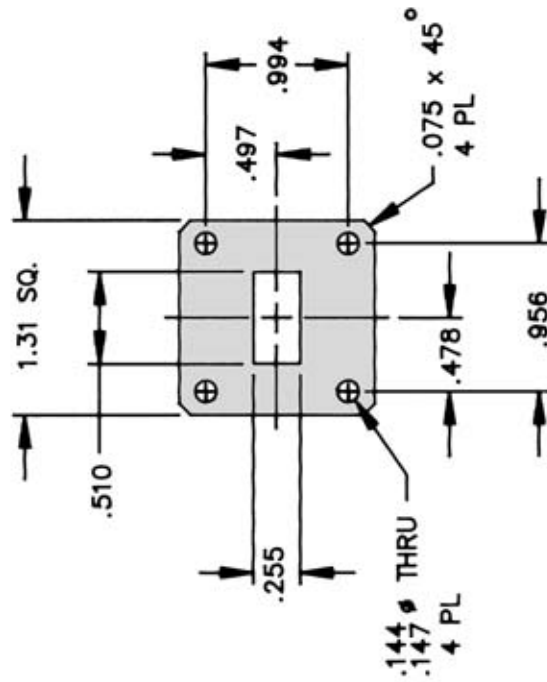
Continental Microwave & Tool Company, Inc.  
 A Chelton Microwave Company  
 11 Continental Drive, Borer, NH 03343-3061  
 Tel: (603) 753-8200, e: cmail@continentalmic.com, fax: (603) 753-3211, URL: www.continentalmic.com

# FLANGE CHOKE

WR 42 (DES-5)

# FLANGE, GROOVED

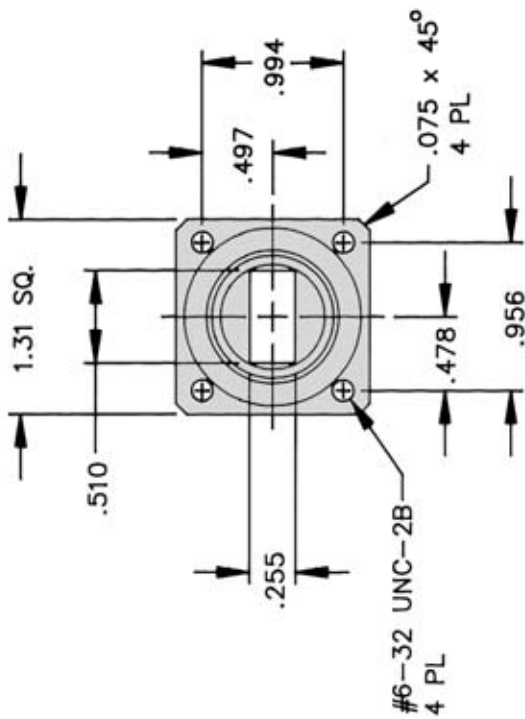
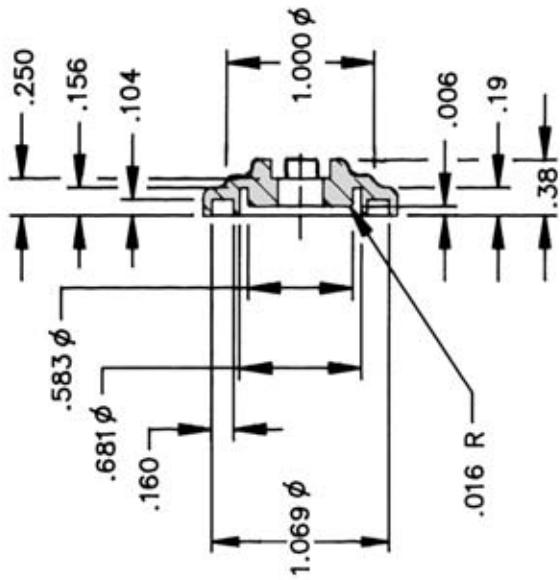
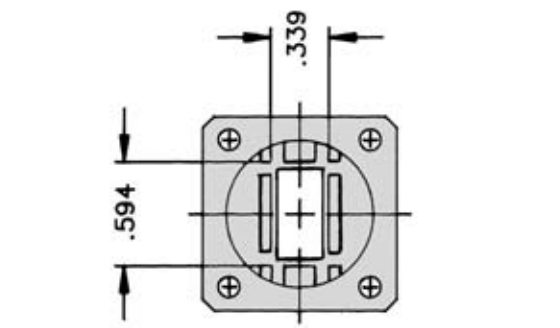
WR 42 (DES-8)



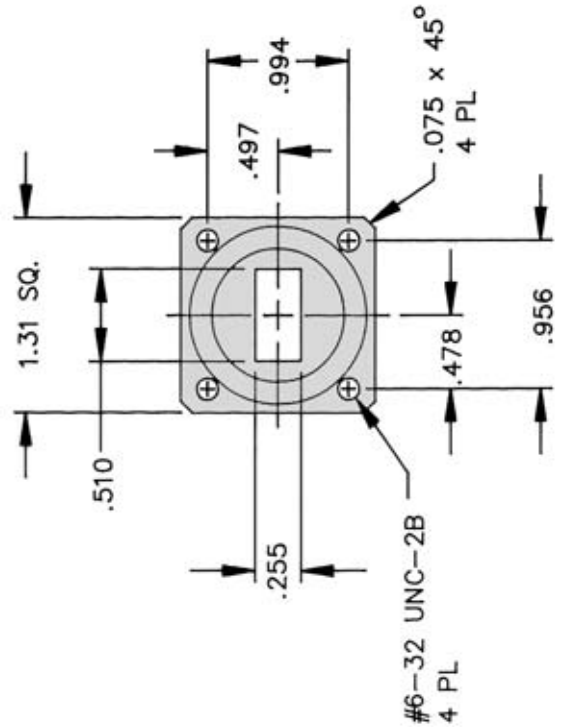
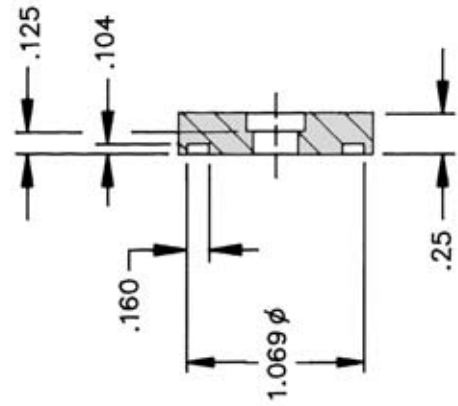
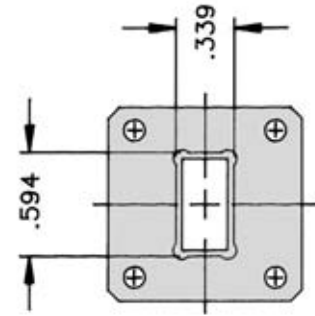
Continental Microwave & Tool Company, Inc.  
 A Chelton Microwave Company  
 1 Continental Drive, Pawcatuck, RI 02861-3308  
 Tel: (603) 775-8200, e-mail: rps@continentalco.com, fax: (603) 775-8211, URL: www.continentalco.com

# FLANGE COVER

WR 51 (DES-1)



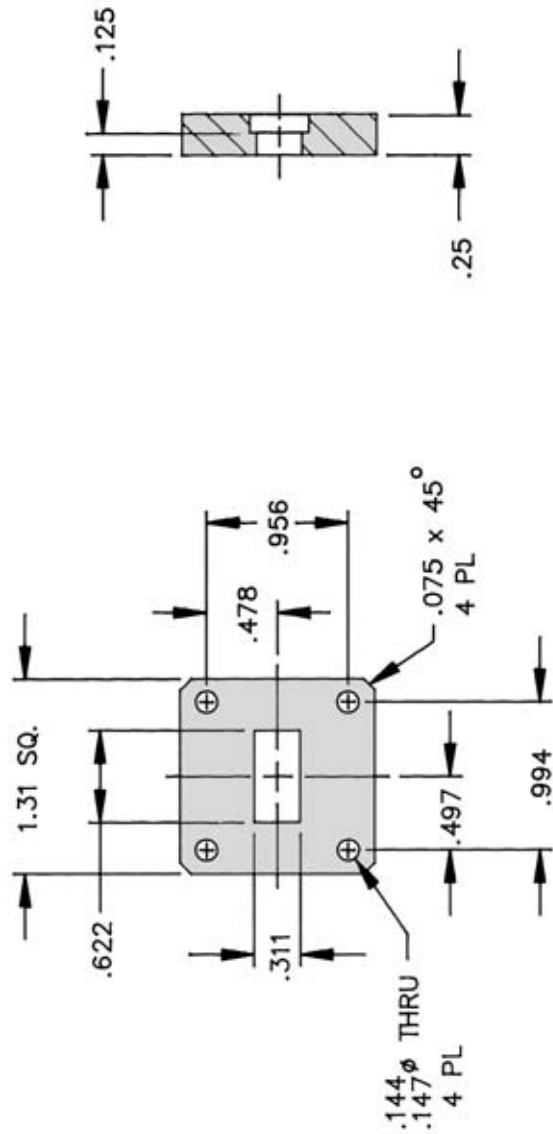
**FLANGE CHOKES**  
WR 51 (DES-5)



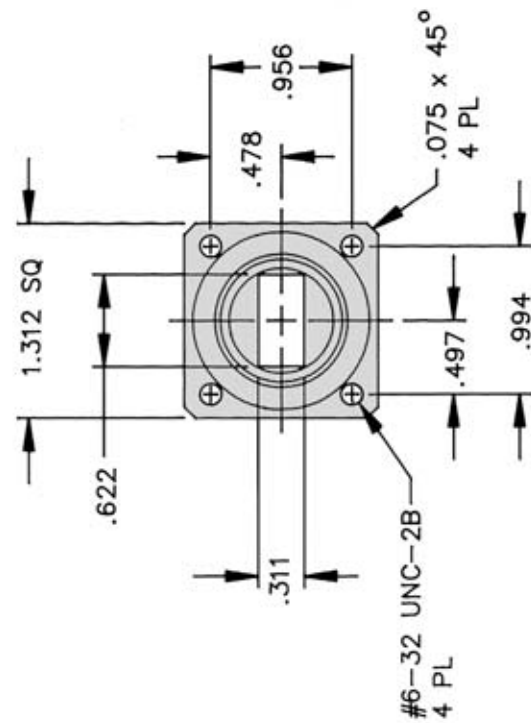
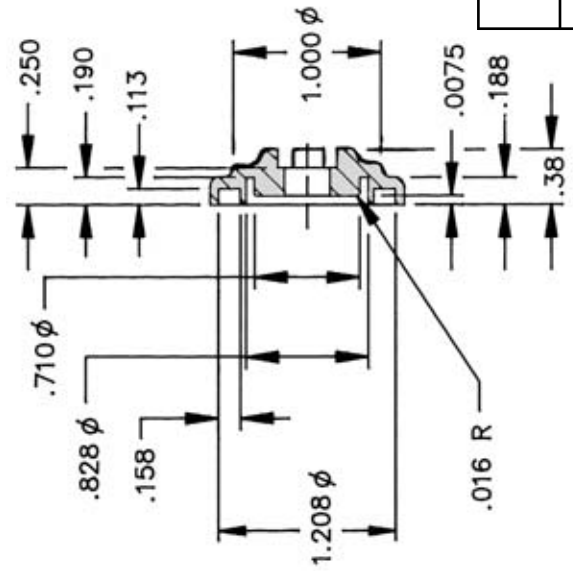
**FLANGE CHOKES**  
WR 51 (DES-8)

Continental Microwave & Tool Company, Inc.  
A Chelton Microwave Company  
1 Continental Drive, Bldg. #103, 31305  
Tel: (601) 775-8200 • e: cmt@continentalmicrowave.com • fax: (601) 775-8211 • URL: www.continentalmicrowave.com





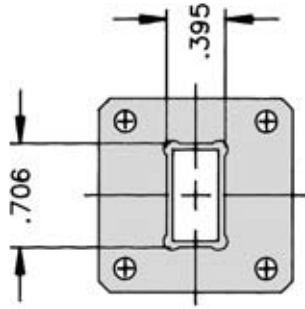
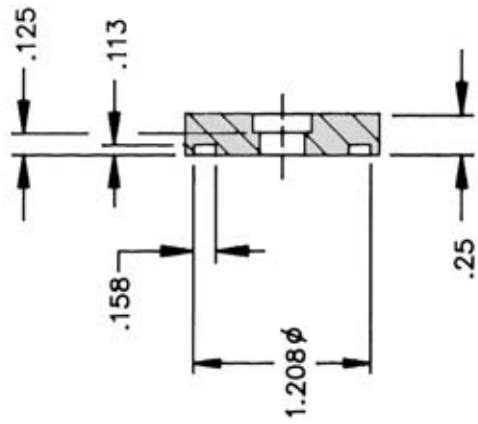
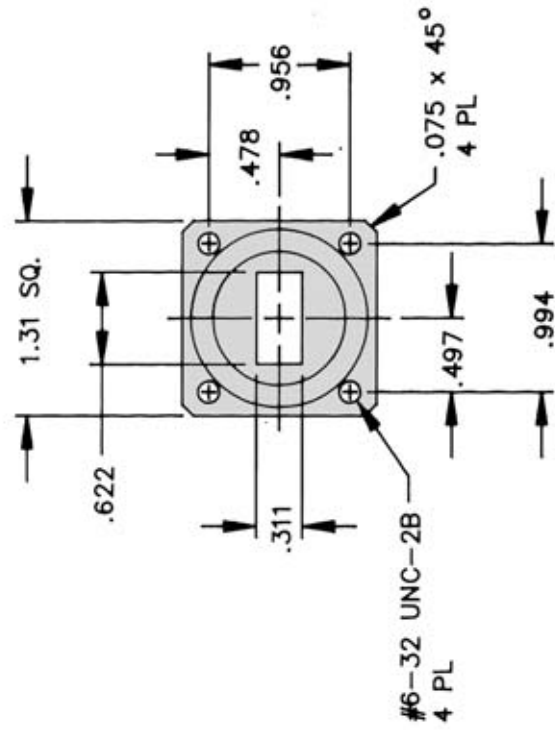
FLANGE COVER  
WR 62 (DES-1)



#6-32 UNC-2B  
4 PL

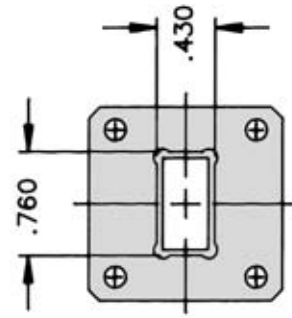
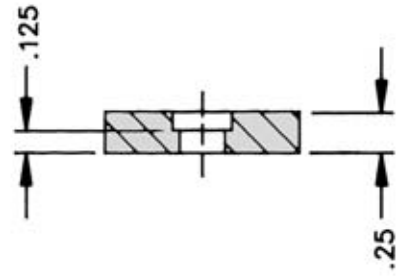
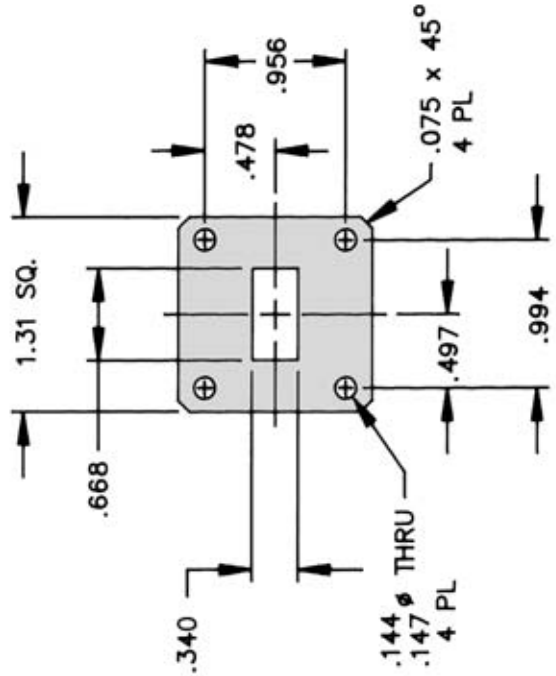
Continental Microwave & Tool Company, Inc.  
A Chelton Microwave Company  
1 Continental Drive, Bower, WI 53003-3004  
Tel: (608) 775-8200, e: cmt@continentalmic.com, fax: (608) 775-8201, URL: www.continmic.com

FLANGE CHOKE  
WR 62 (DES-5)



# FLANGE, GROOVED

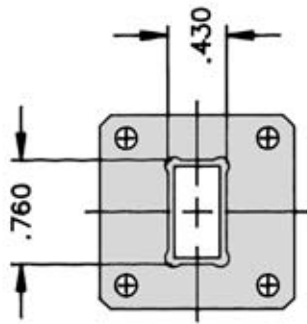
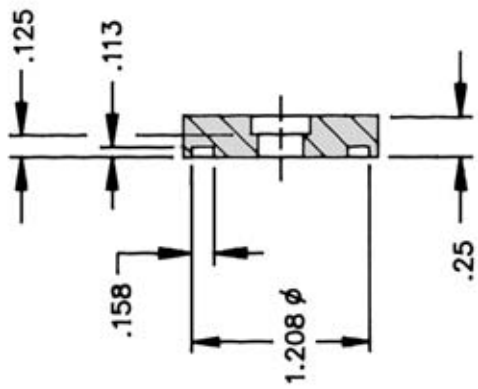
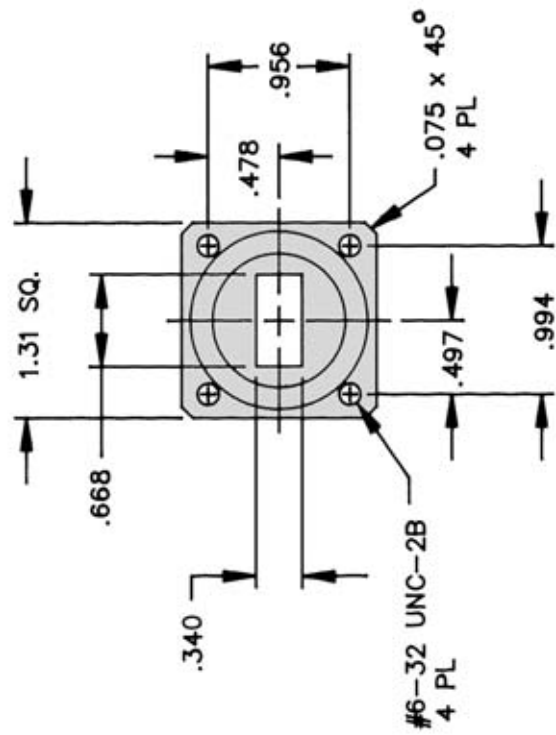
WR 62 (DES-8)



Continental Microwave & Tool Company, Inc.  
 A Chelton Microwave Company  
 11 Continental Drive, Dover, NH 03843-0506  
 Tel: (603) 753-8200, e: cmt@continentalmco.com, fax: (603) 753-8211, URL: www.continentalmco.com

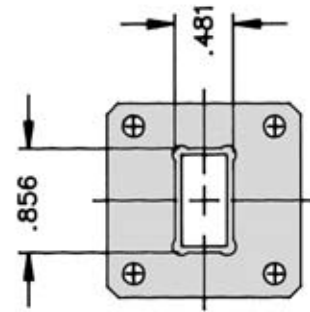
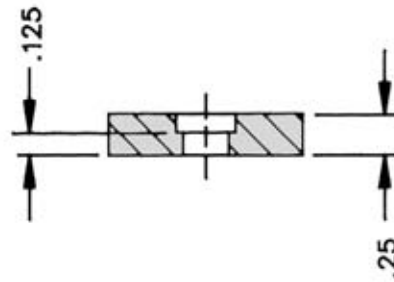
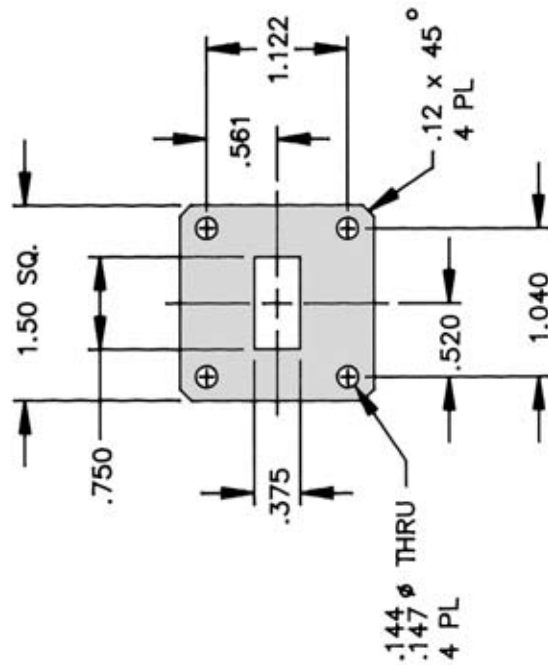
# FLANGE COVER

WR 67 (DES-1)



## FLANGE, GROOVED

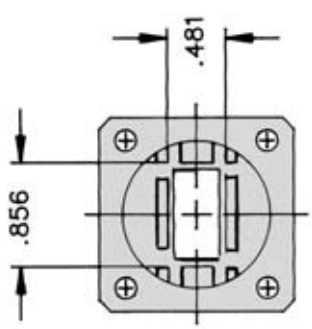
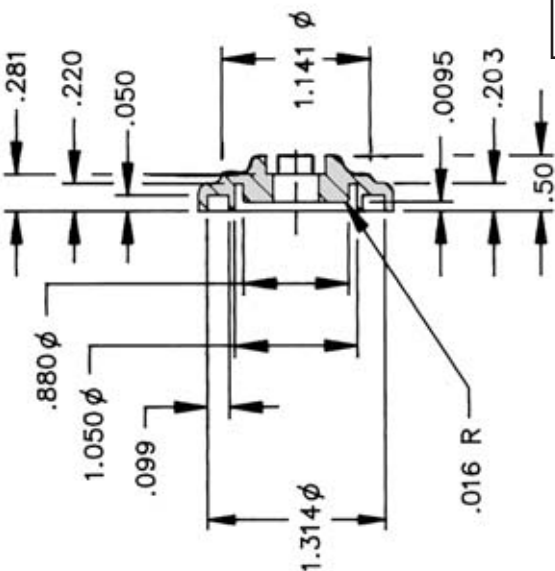
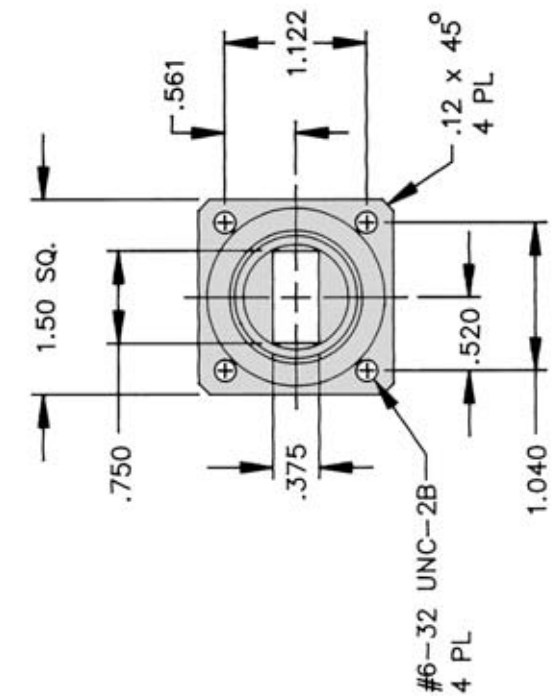
WR 67 (DES-8)



Continental Microwave & Tool Company, Inc.  
 A Chelton Microwave Company  
 1 Continental Drive, Bover, RI 02833-3504  
 Tel: (603) 753-8300, e: cmt@continentalco.com, fax: (603) 753-8311, URL: www.continentalco.com

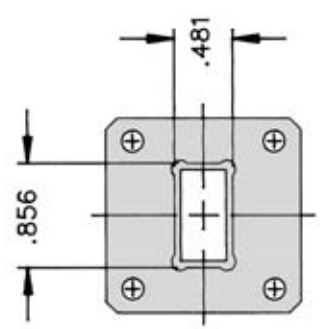
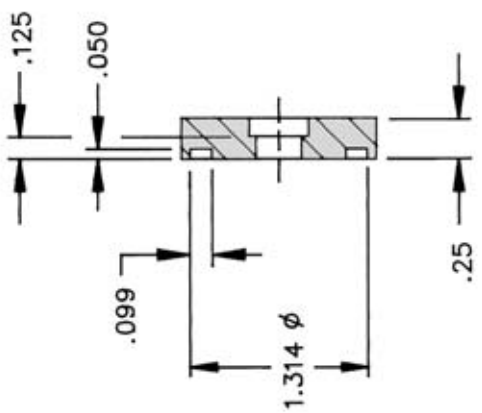
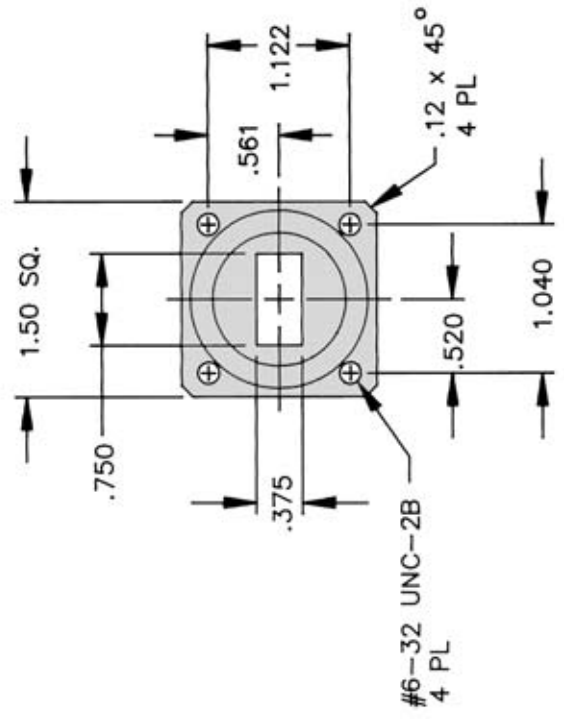
## FLANGE COVER

WR 75 (DES-1)



# FLANGE CHOKE

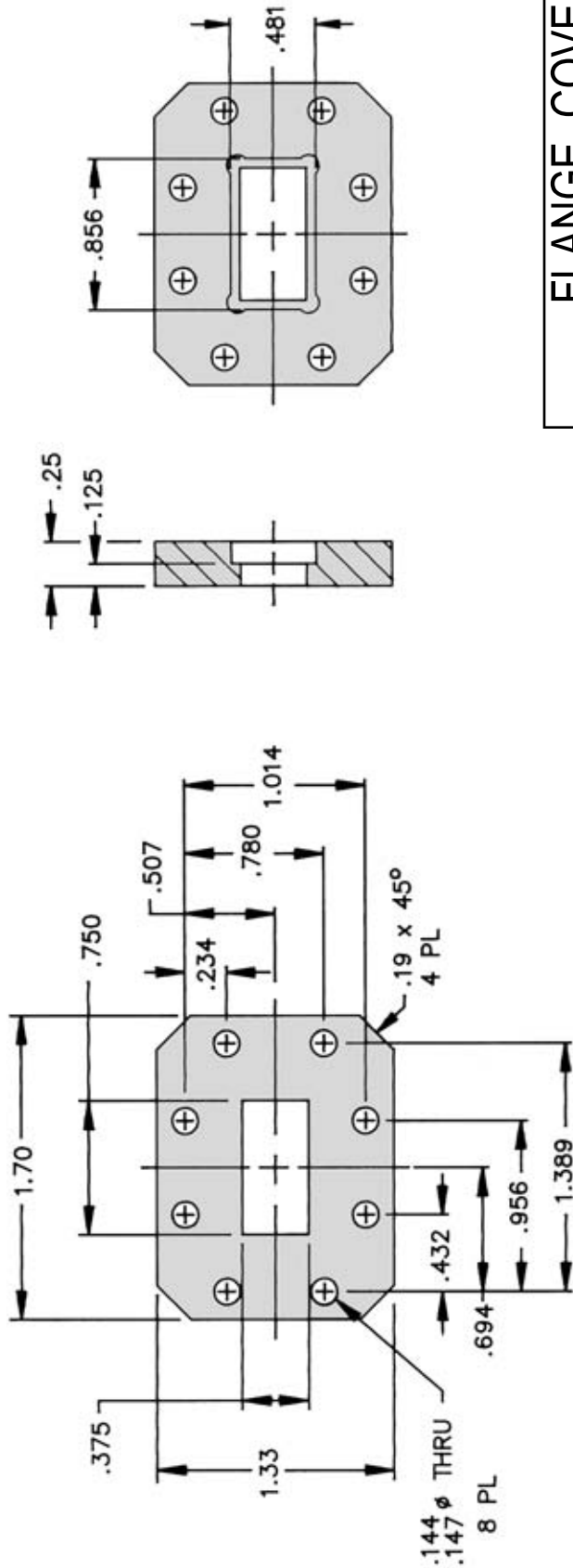
WR 75 (DES-5)



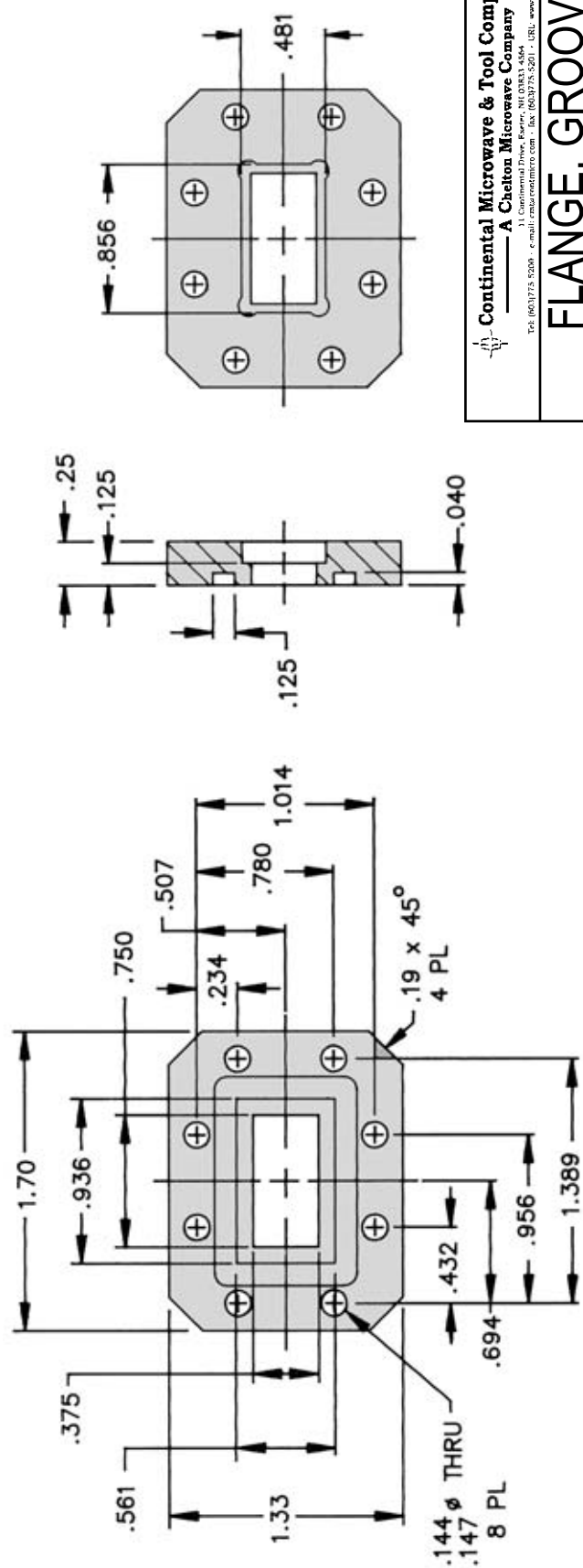
Continental Microwave & Tool Company, Inc.  
 A Chelton Microwave Company  
 11 Continental Drive, Broomfield, CO 80020  
 Tel: (800) 775-5200 • e: cmi@continentalco.com • fax: (303) 751-5211 • URL: www.continentalco.com

# FLANGE, GROOVED

WR 75 (DES-8)

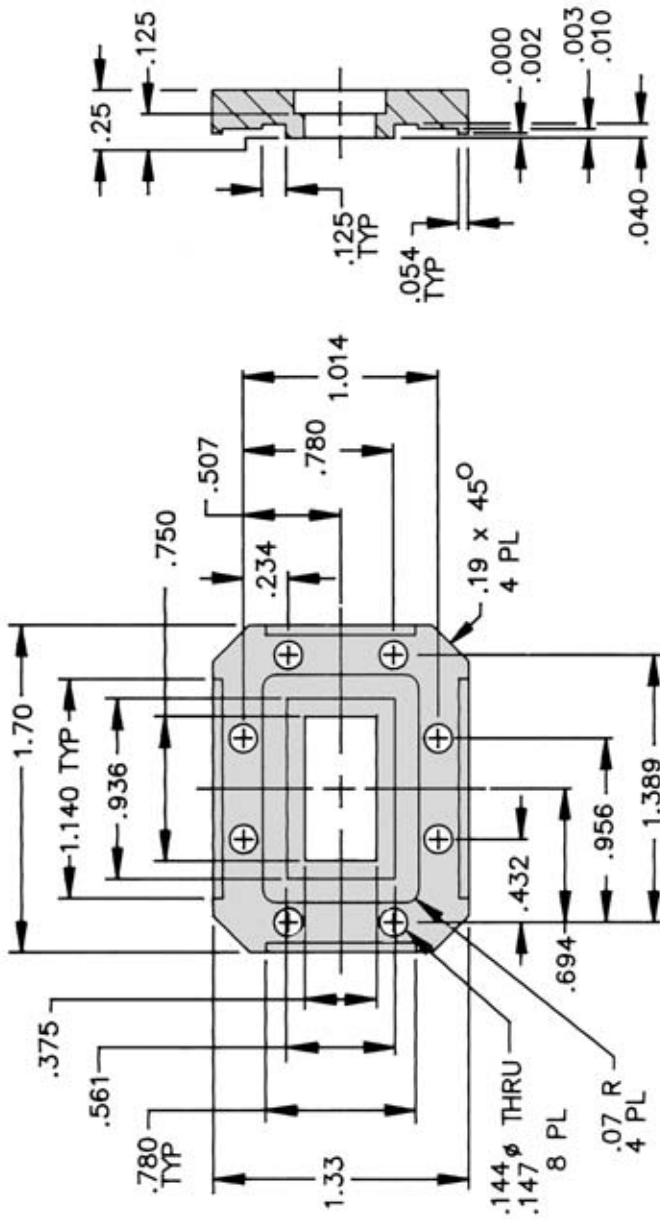


**FLANGE COVER**  
CPR 75 (DES-13)



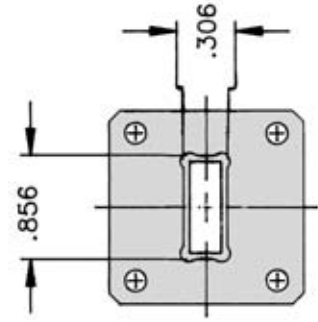
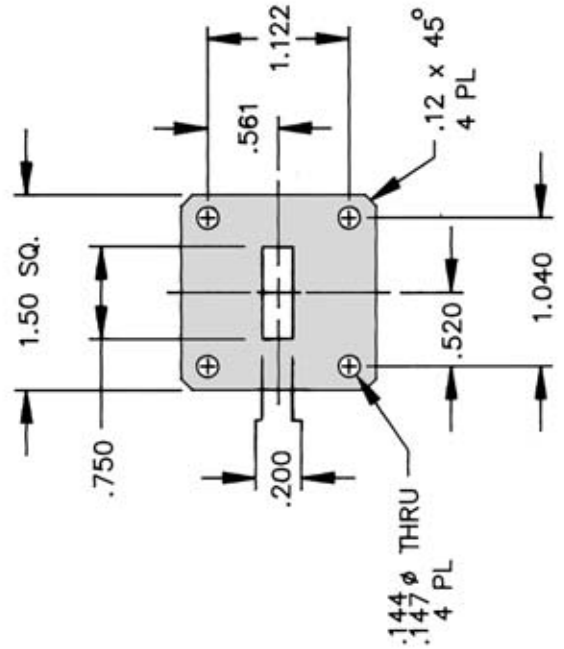
**FLANGE, GROOVED**  
CPR 75 (DES-10)

Continental Microwave & Tool Company, Inc.  
A Chelton Microwave Company  
1 Continental Drive, Brierley, MA 01933-5007  
Tel: (603) 753-8200, e: cmail@continentalmco.com, fax: (603) 753-8201, URL: www.continentalmco.com



## FLANGE CONTACT

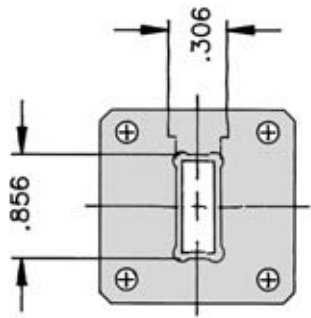
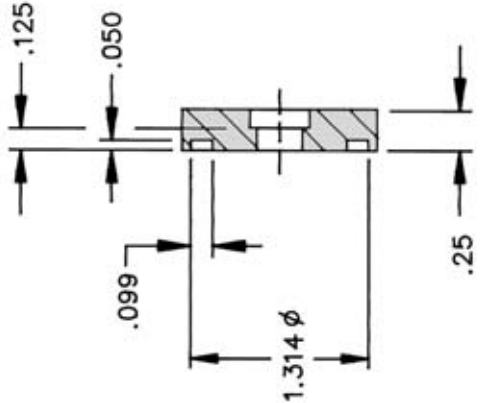
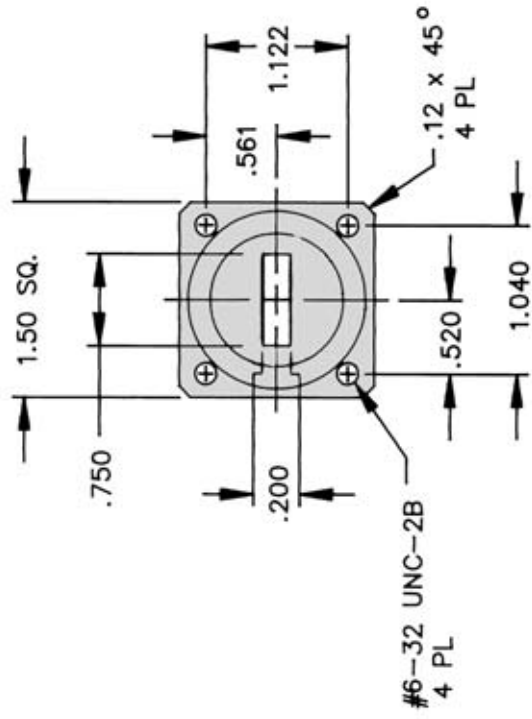
CPR 75 (DES-16)



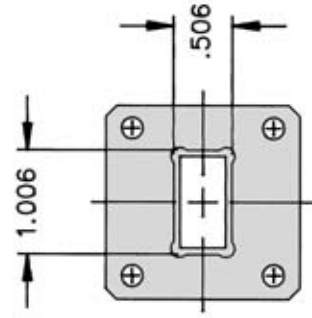
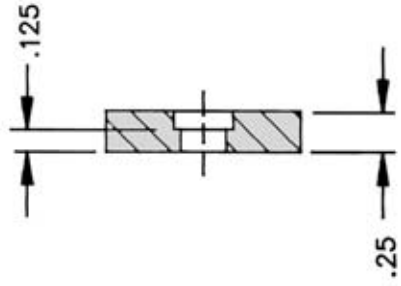
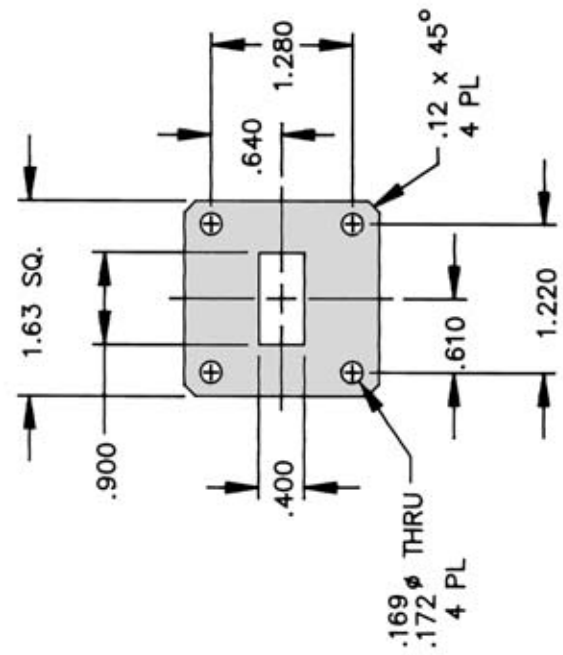
Continental Microwave & Tool Company, Inc.  
 A Chelton Microwave Company  
 1 Continental Drive, Bunker, NH 03343-0506  
 Tel: (603) 753-8200, e: cmail:cmw@continentalco.com, fax: (603) 753-8211, URL: www.continentalco.com

## FLANGE COVER

WR 75 R/H (DES-1R)

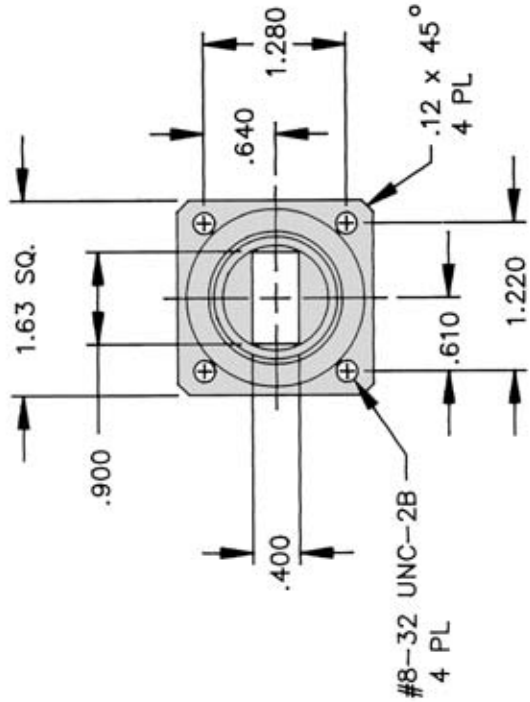
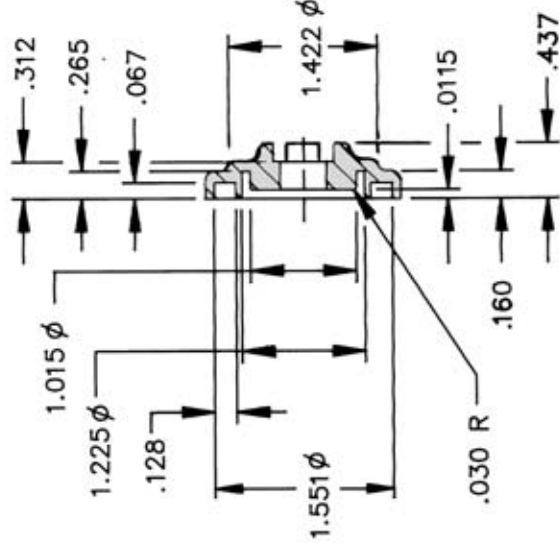


### FLANGE, GROOVED WR 75 R/H (DES-8R)



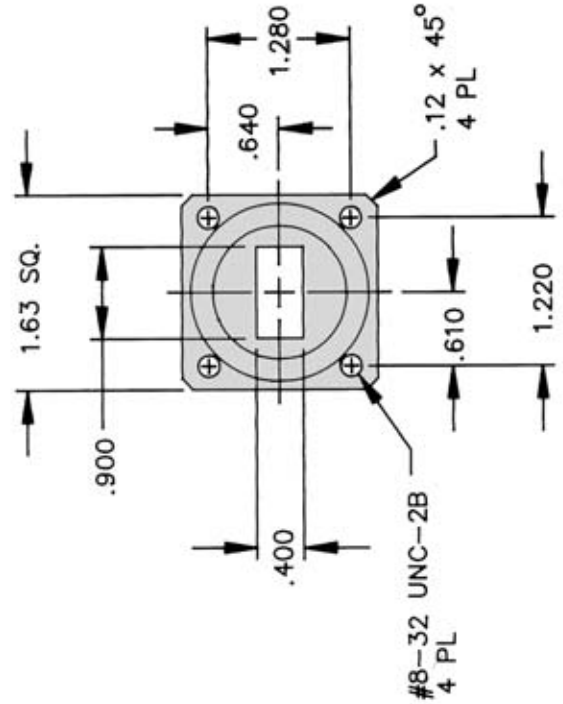
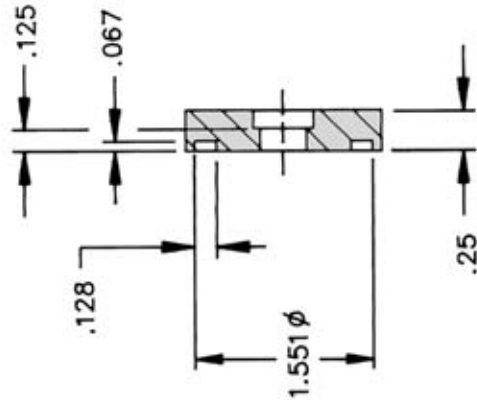
Continental Microwave & Tool Company, Inc.  
A Chelton Microwave Company  
1 Continental Drive, Bunker, WI 53003-3066  
Tel: (608) 775-8200, e: cmt@continentalmic.com, fax: (608) 775-8211, URL: www.continmic.com

### FLANGE COVER WR 90 (DES-1)



## FLANGE CHOKES

WR 90 (DES-5)

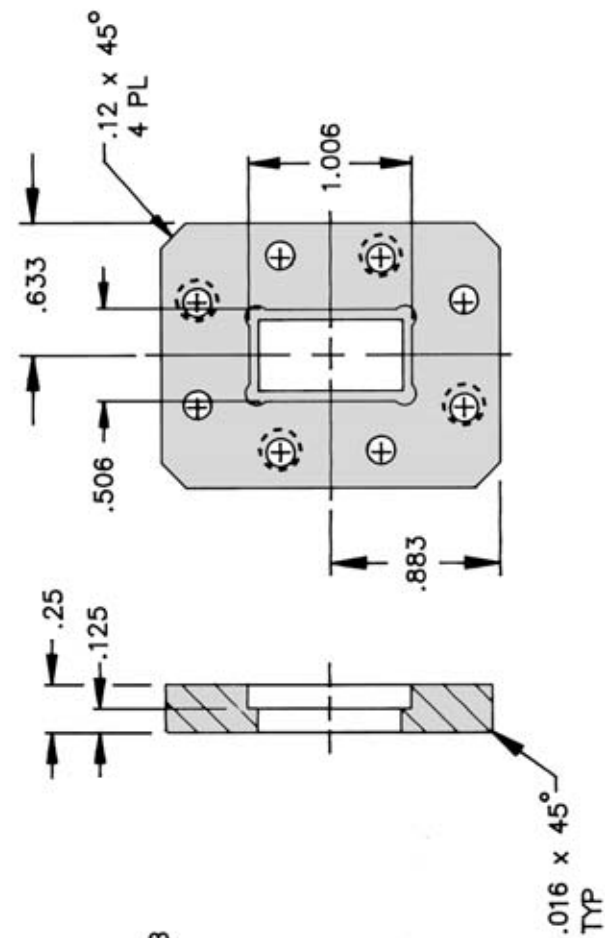


Continental Microwave & Tool Company, Inc.  
 A Chelton Microwave Company  
 1 Continental Drive, Elmer, NJ 08521-3506  
 Tel: (609) 775-8200, e: cml@continentalmic.com, fax: (609) 775-8211, URL: www.continentalmic.com

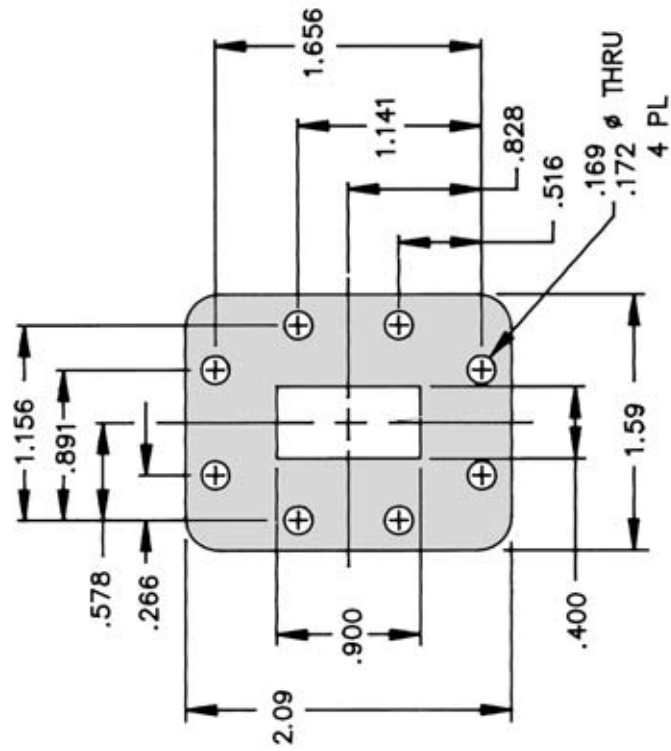
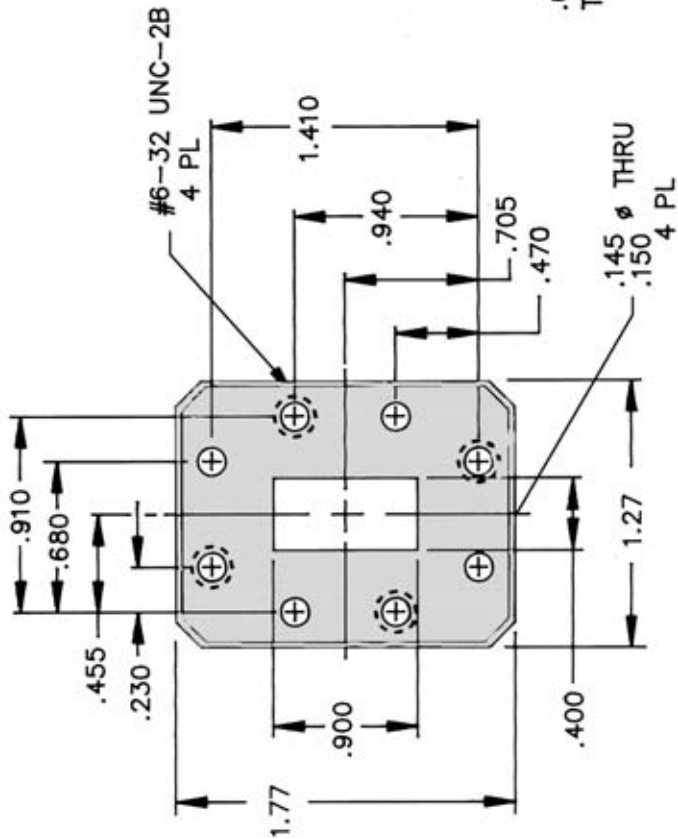
## FLANGE GROOVES

WR 90 (DES-8)



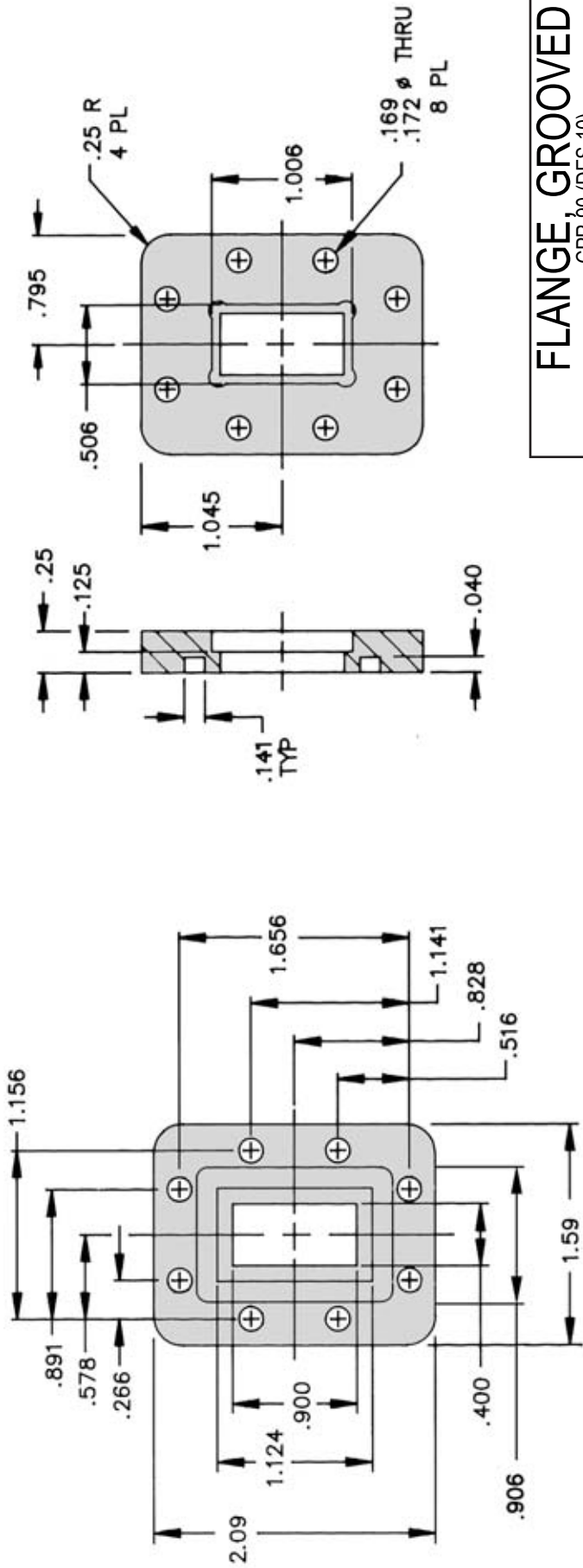


### FLANGE COVER CMR 90 (DES-21)



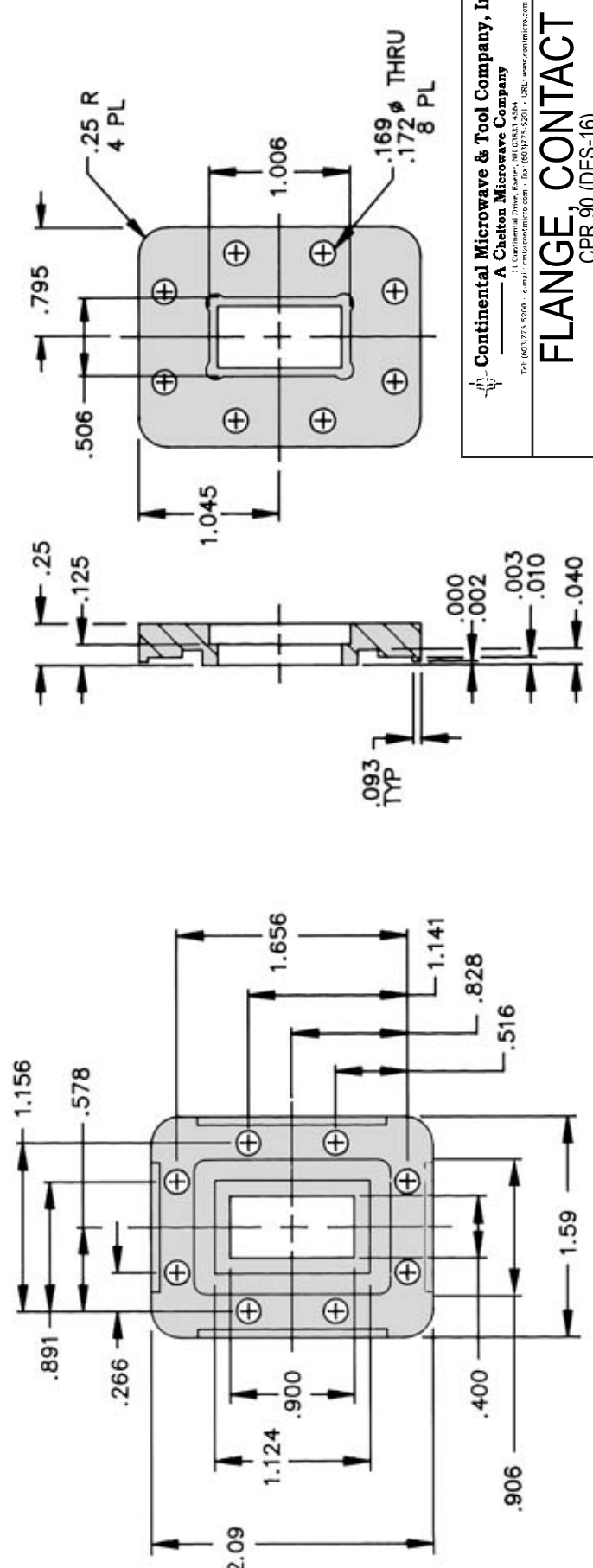
Continental Microwave & Tool Company, Inc.  
 A Chelton Microwave Company  
 1 Continental Drive, Brierley, MA 01543-5067  
 Tel: (603) 775-9200, e: cmail@cmrinc.com, fax: (603) 775-9211, URL: www.cmrinc.com

### FLANGE COVER CPR 90 (DES-13)



# FLANGE GROOVED

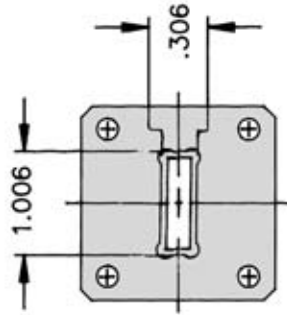
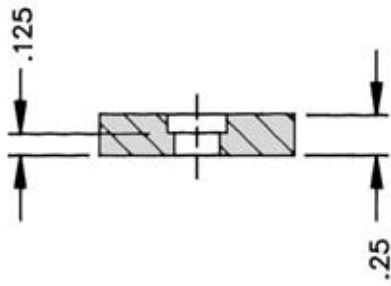
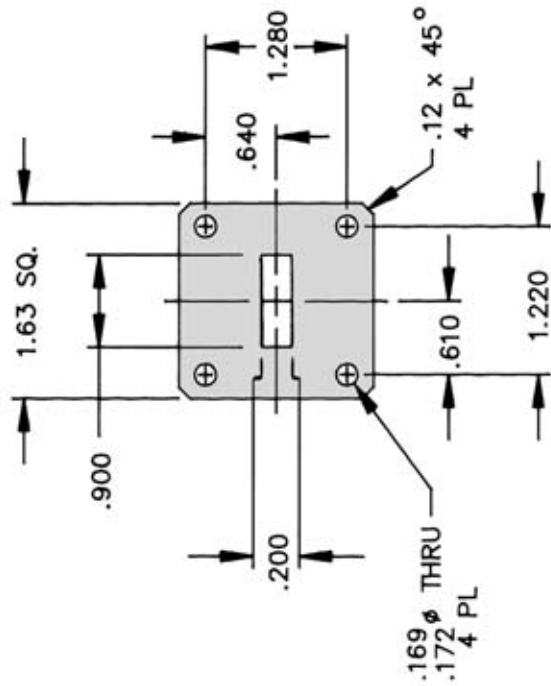
CPR 90 (DES-10)



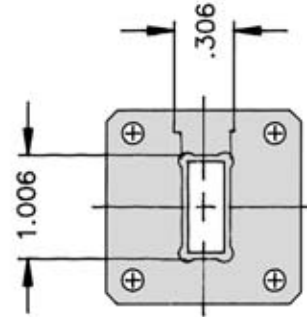
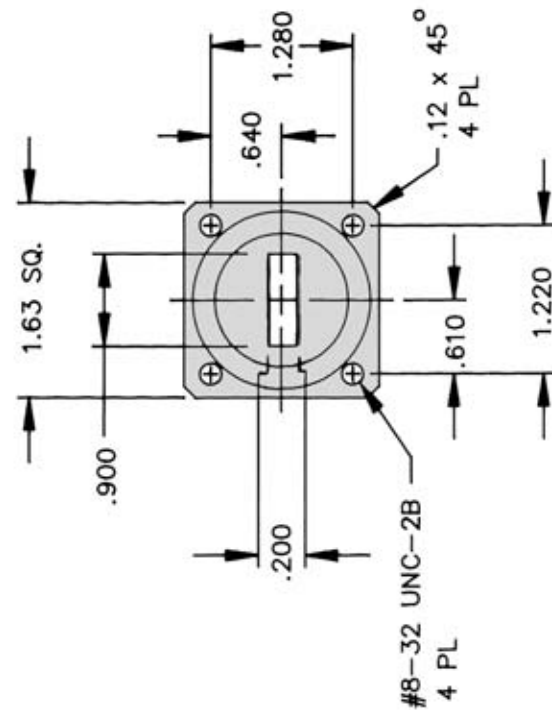
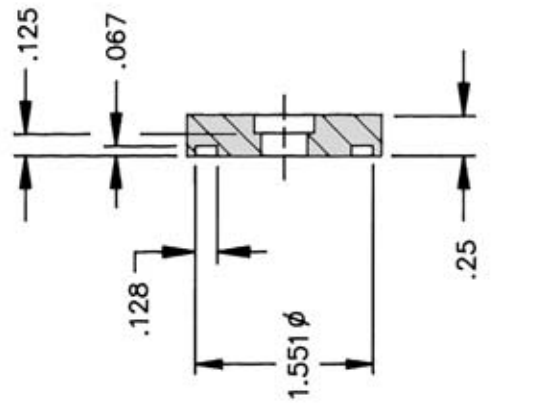
Continental Microwave & Tool Company, Inc.  
 A Chelton Microwave Company  
 1 Continental Drive, Dover, NH 03843 USA  
 Tel: (603) 753-8200, e: cmail@continentalmic.com, fax: (603) 753-8211, URL: www.continentalmic.com

# FLANGE CONTACT

CPR 90 (DES-16)

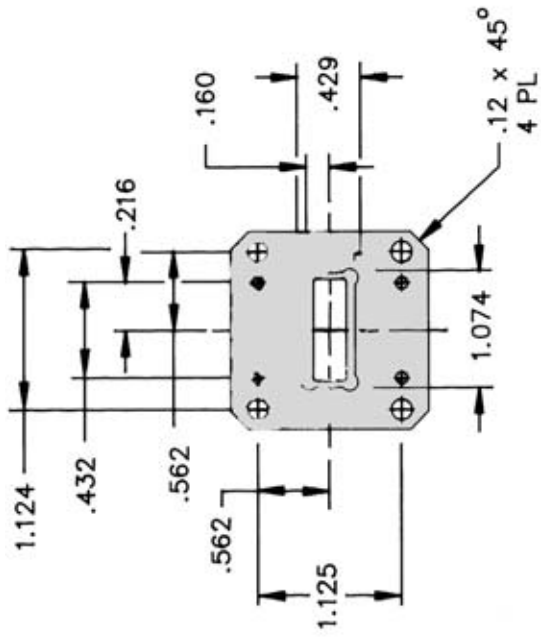


**FLANGE COVER**  
WR 90 R/H (DES-1R)



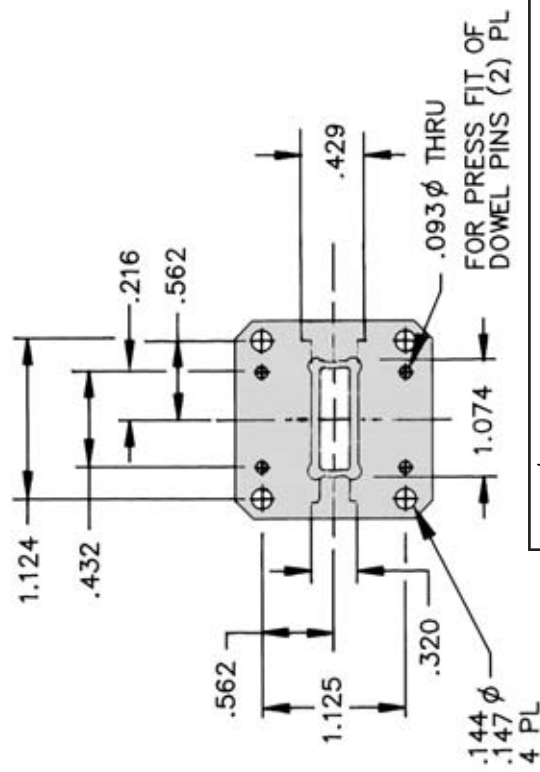
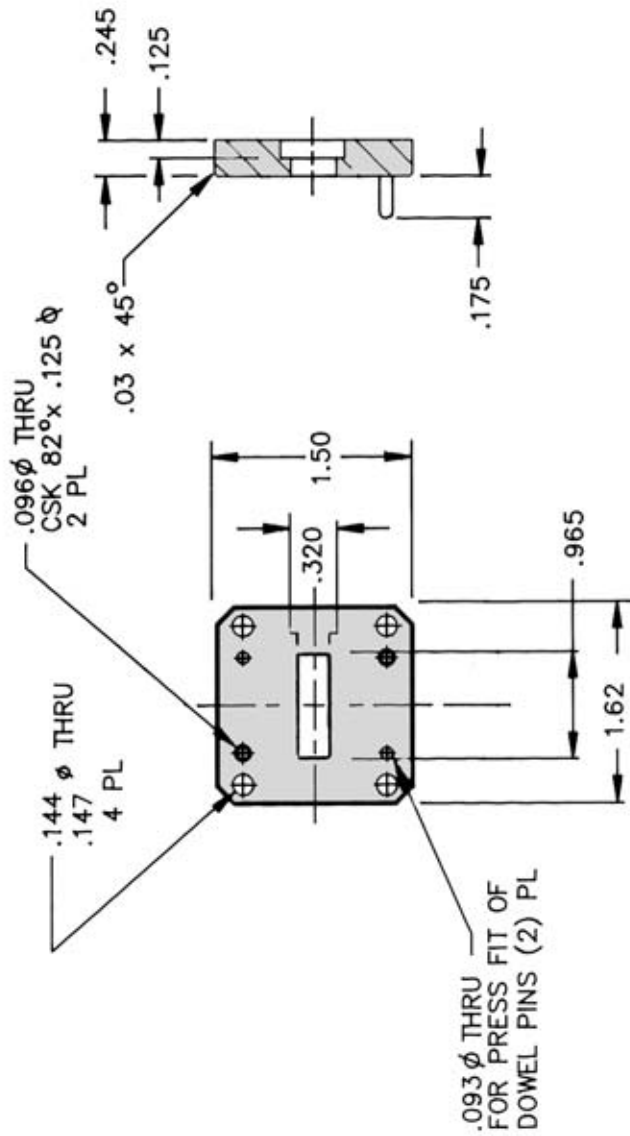
**Continental Microwave & Tool Company, Inc.**  
A Chelton Microwave Company  
1 Continental Drive, Borer, WI 53543-0509  
Tel: (608) 775-8200, e: cmt@continentalmco.com, fax: (608) 775-8201, URL: www.continentalmco.com

**FLANGE, GROOVED**  
WR 90 R/H (DES-8R)



# FLANGE COVER

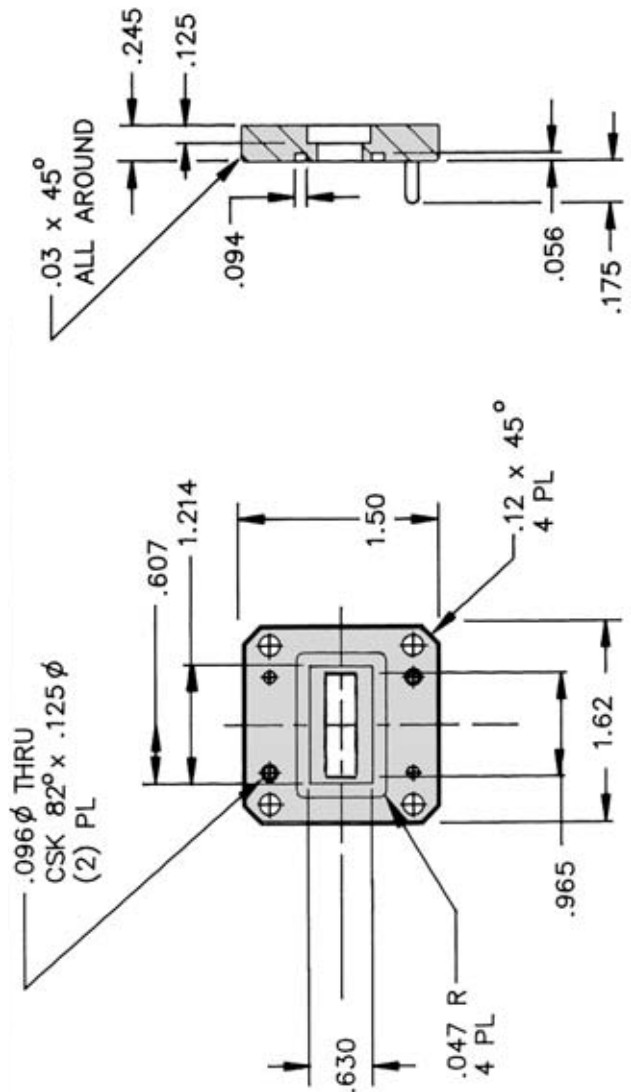
WR 96 (DES-1)

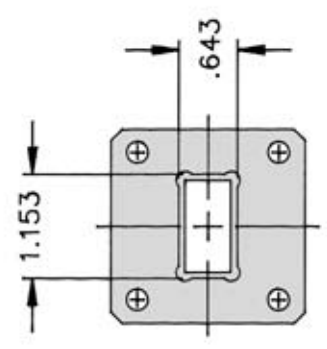
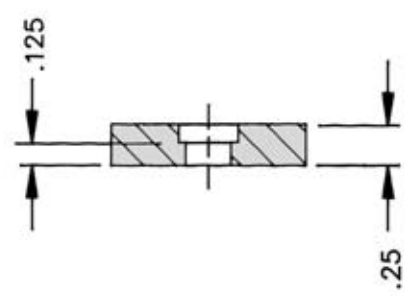
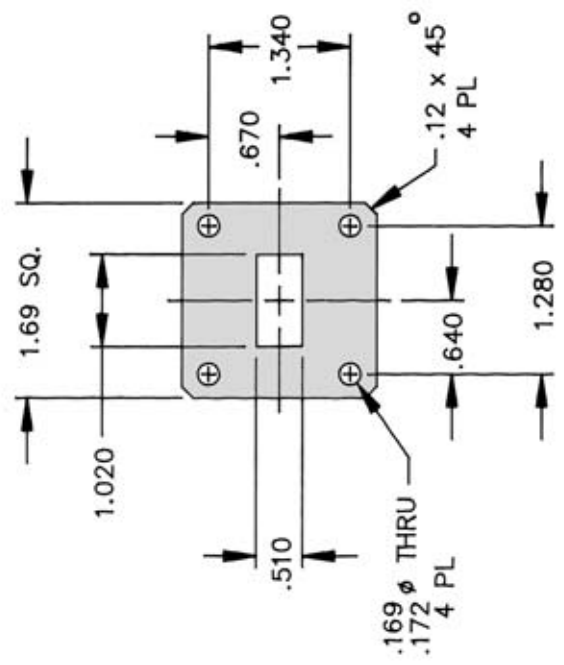


Continental Microwave & Tool Company, Inc.  
 A Chelton Microwave Company  
 11 Continental Drive, Bower, WI 53003 USA  
 Tel: (608) 775-8200, e: cmt@continentalmicrow.com, fax: (608) 775-8211, URL: www.continentalmicrow.com

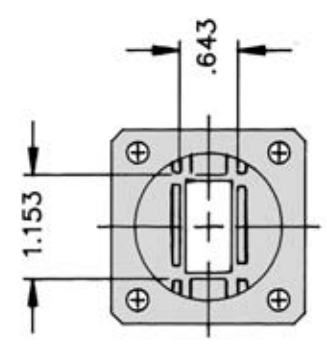
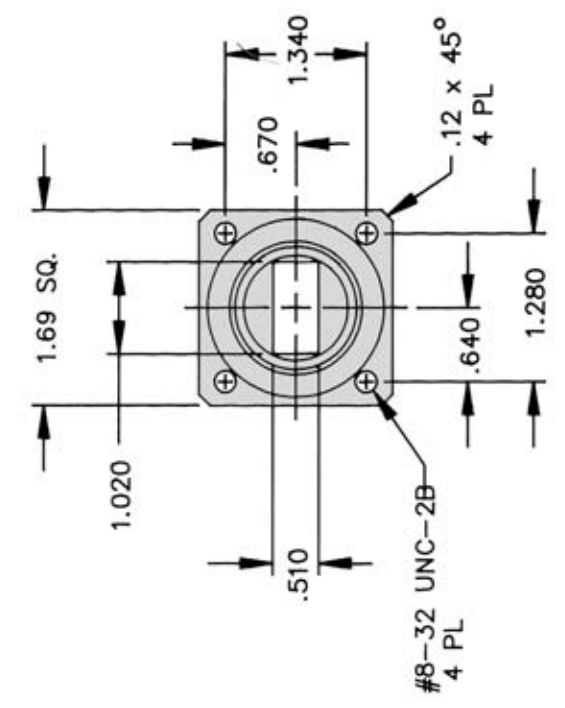
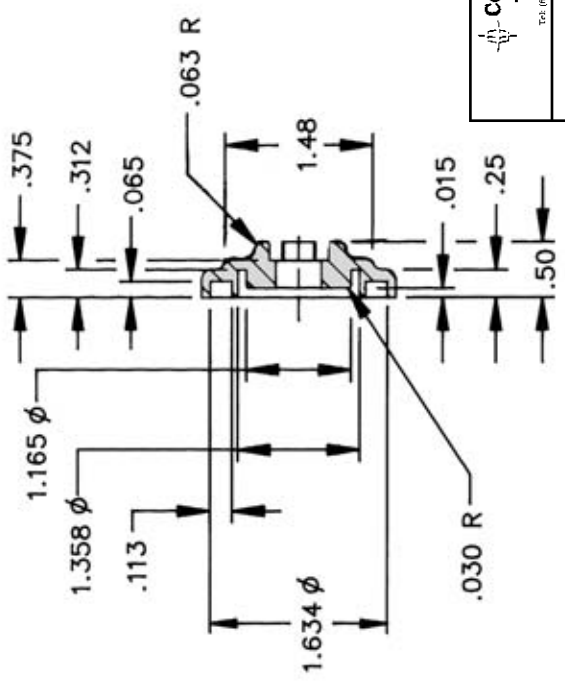
# FLANGE GROOVED

WR 96 (DES-8)



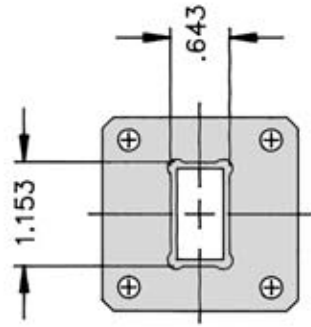
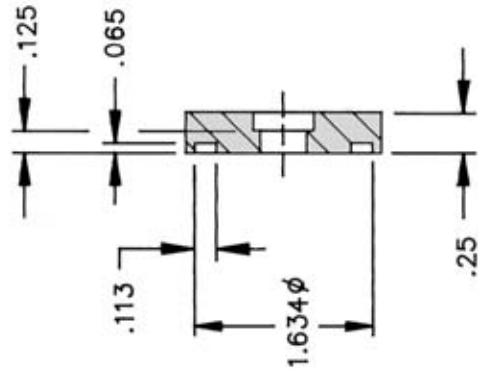
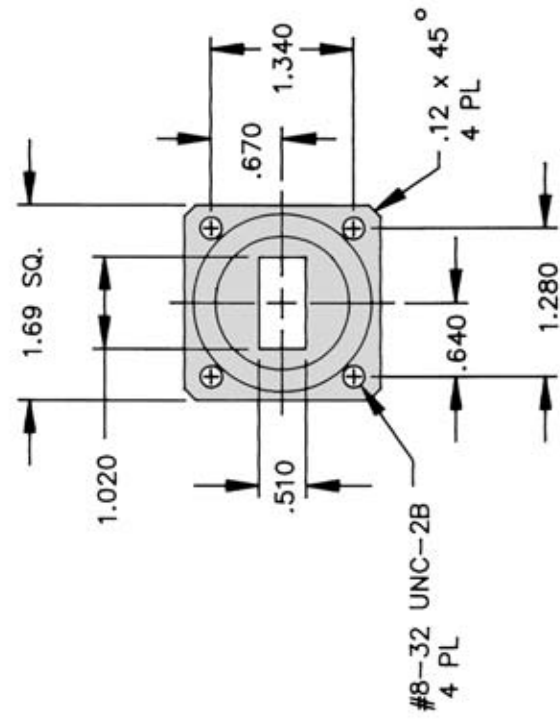


**FLANGE COVER**  
WR 102 (DES-1)



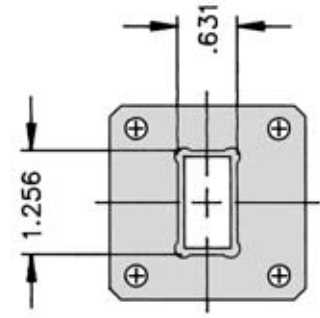
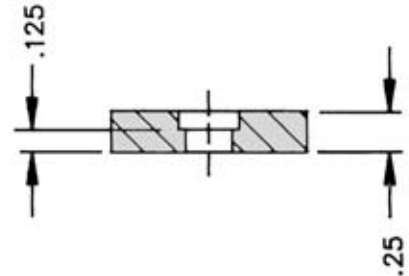
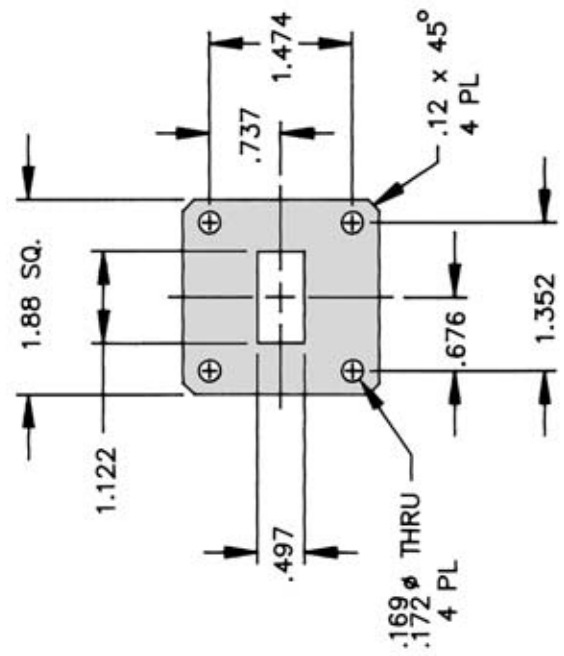
Continental Microwave & Tool Company, Inc.  
A Chelton Microwave Company  
1 Continental Drive, Bower, MI 48343-3066  
Tel: (601) 775-8200, e: cmt@continentalmicrowave.com, fax: (601) 775-8201, URL: www.continentalmic.com

**FLANGE, CHOKE**  
WR 102 (DES-5)



# FLANGE, GROOVED

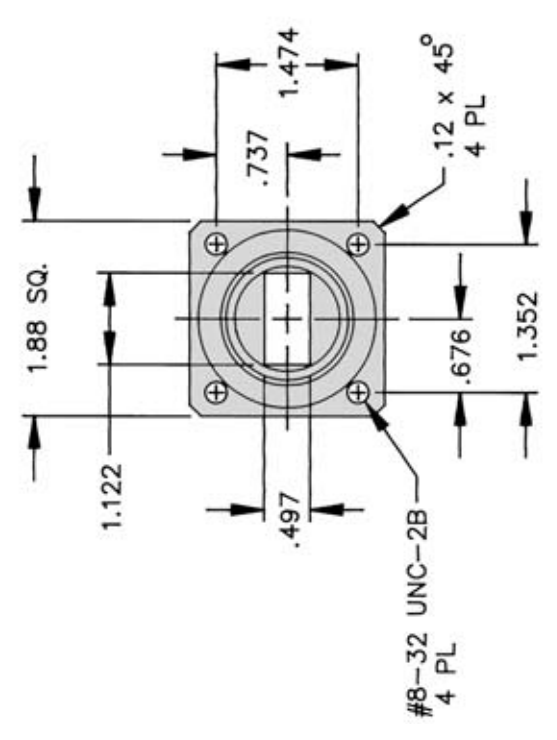
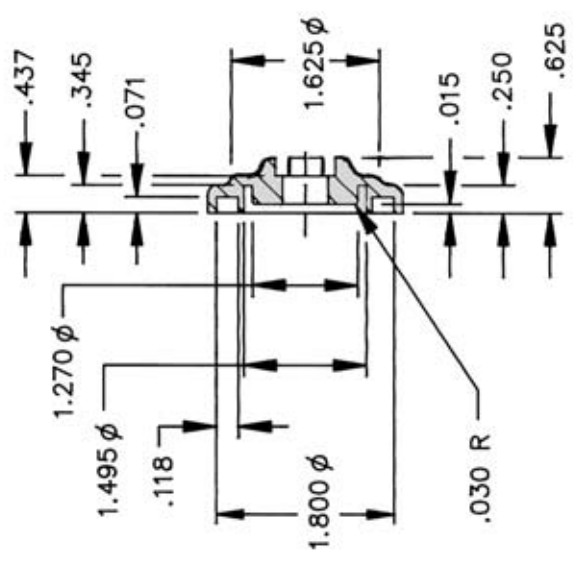
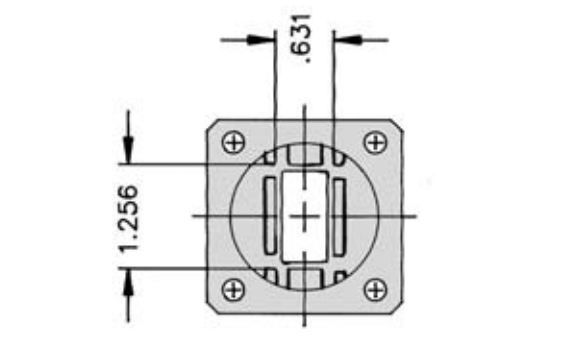
WR 102 (DES-8)



# FLANGE, COVER

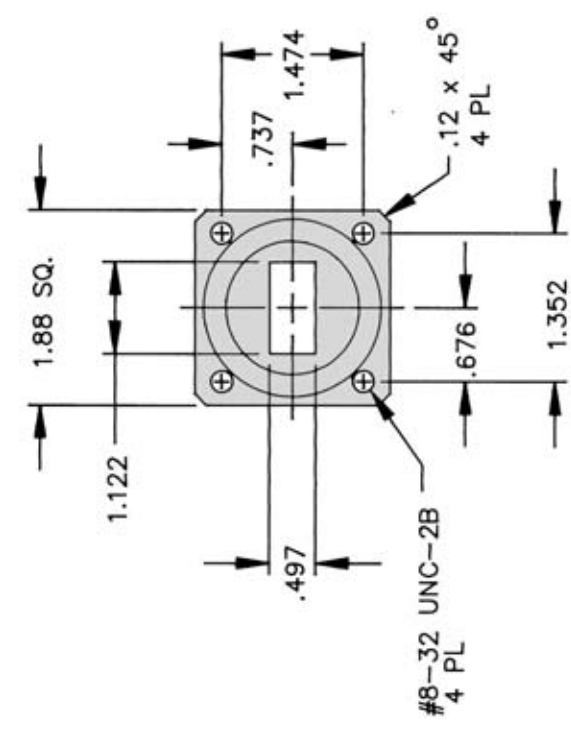
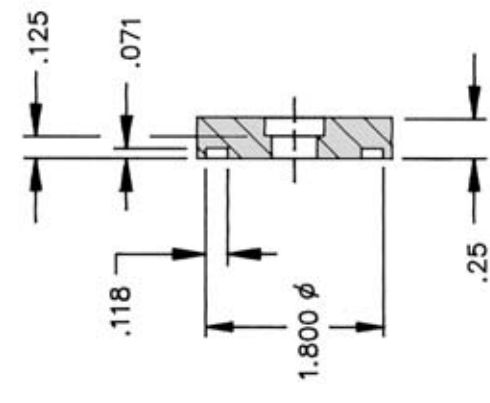
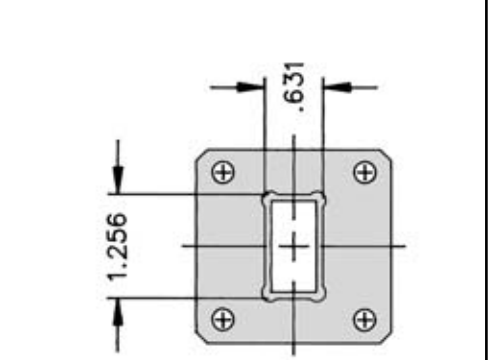
WR 112 (DES-1)

Continental Microwave & Tool Company, Inc.  
 A Chelton Microwave Company  
 1 Continental Drive, Bunker, NH 03343-3006  
 Tel: (603) 753-8300, e-mail: rps@continental.com, fax: (603) 753-8321, URL: www.continental.com



# FLANGE, CHOKE

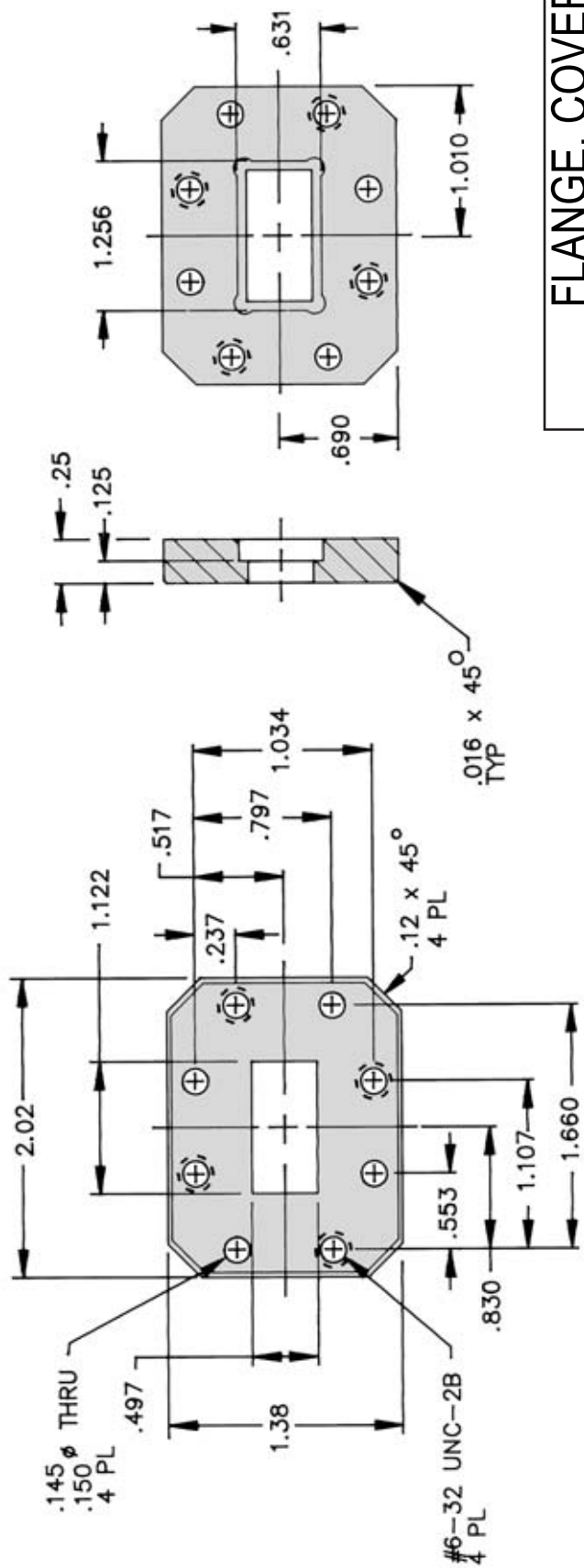
WR 112 (DES-5)



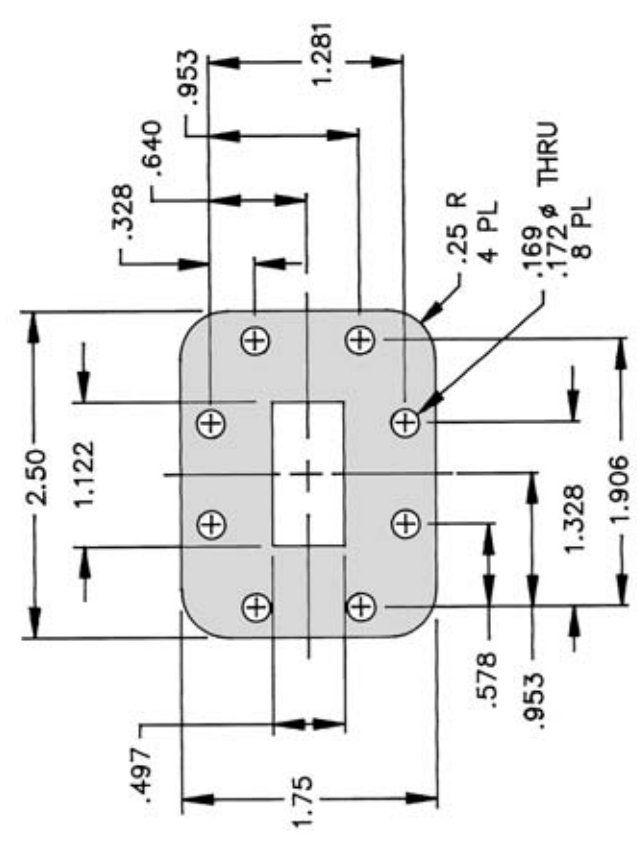
Continental Microwave & Tool Company, Inc.  
— A Chelton Microwave Company  
1 Continental Drive, Bunker Hill, MA 01930  
Tel: (603) 775-9300, e: [contmic@contmic.com](mailto:contmic@contmic.com), fax: (603) 775-9321, URL: [www.contmic.com](http://www.contmic.com)

# FLANGE, GROOVED

WR 112 (DES-8)



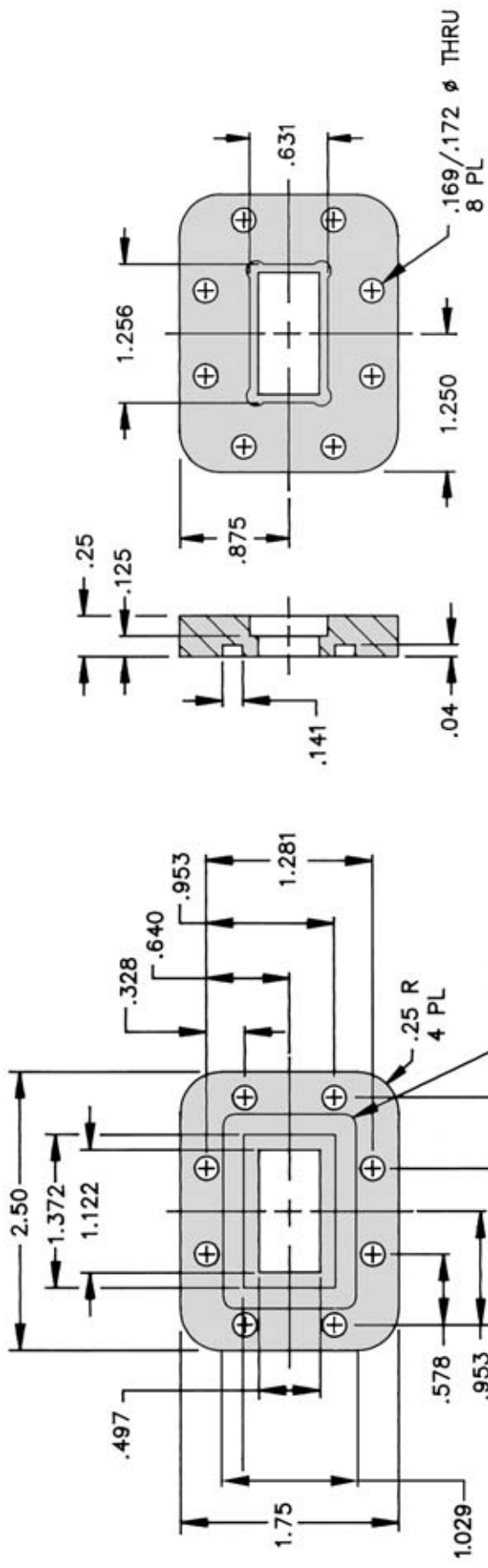
**FLANGE COVER**  
CMR 112 (DES-21)



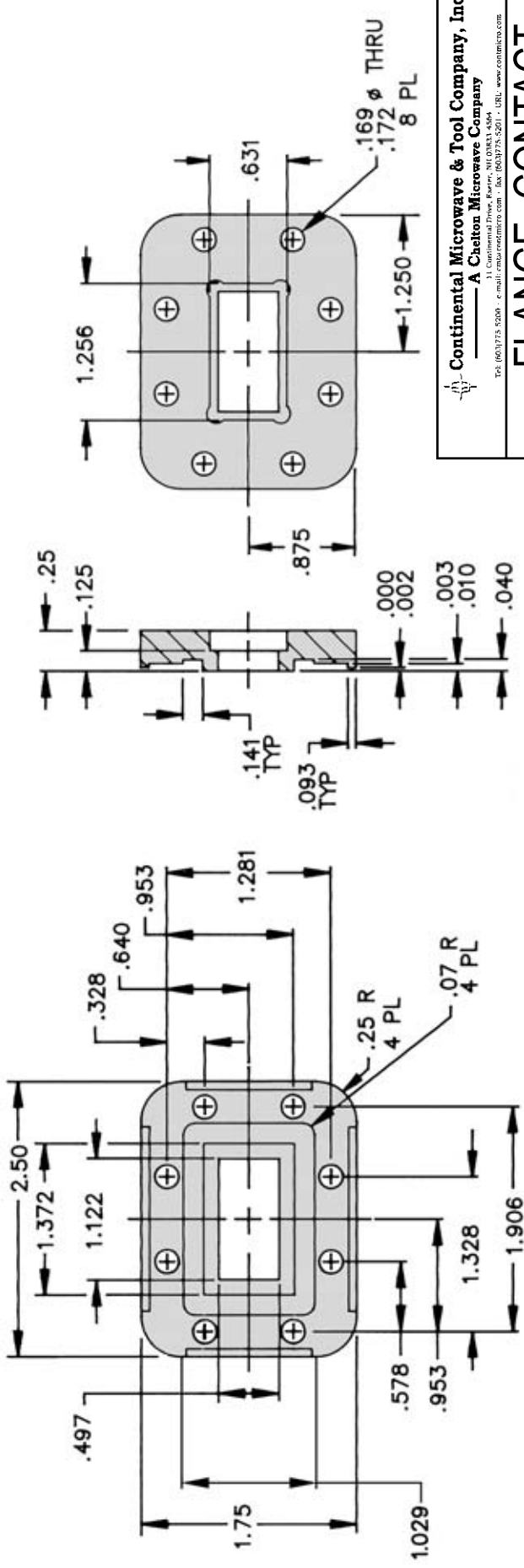
**FLANGE COVER**  
CPR 112 (DES-13)

Continental Microwave & Tool Company, Inc.  
A Chelton Microwave Company  
1 Continental Drive, Bloor, MI 48303-3506  
Tel: (601) 775-9200, e: cmail@cmrtools.com, fax: (601) 775-9211, URL: www.cmrtools.com





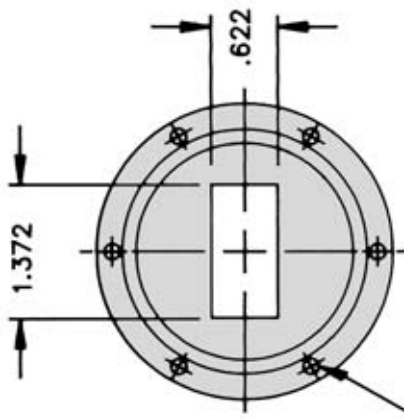
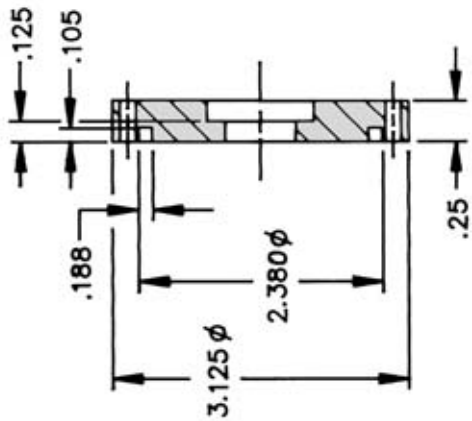
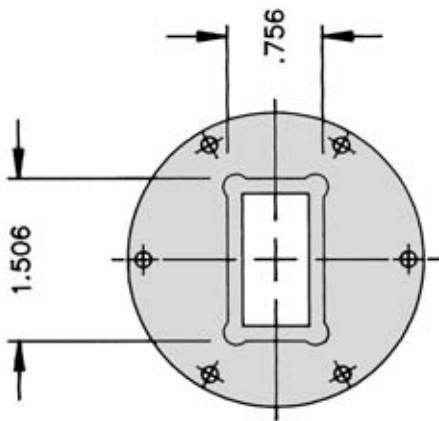
**FLANGE, GROOVED**  
CPR 112 (DES-10)



**FLANGE CONTACT**  
CPR 112 (DES-16)

Continental Microwave & Tool Company, Inc.  
A Chelton Microwave Company  
1 Continental Drive, Tower, MI 48343-6566  
Tel: (601) 775-8200, e: cmt@continentalmicrowave.com, fax: (601) 775-8211, URL: www.continentalmicrowave.com

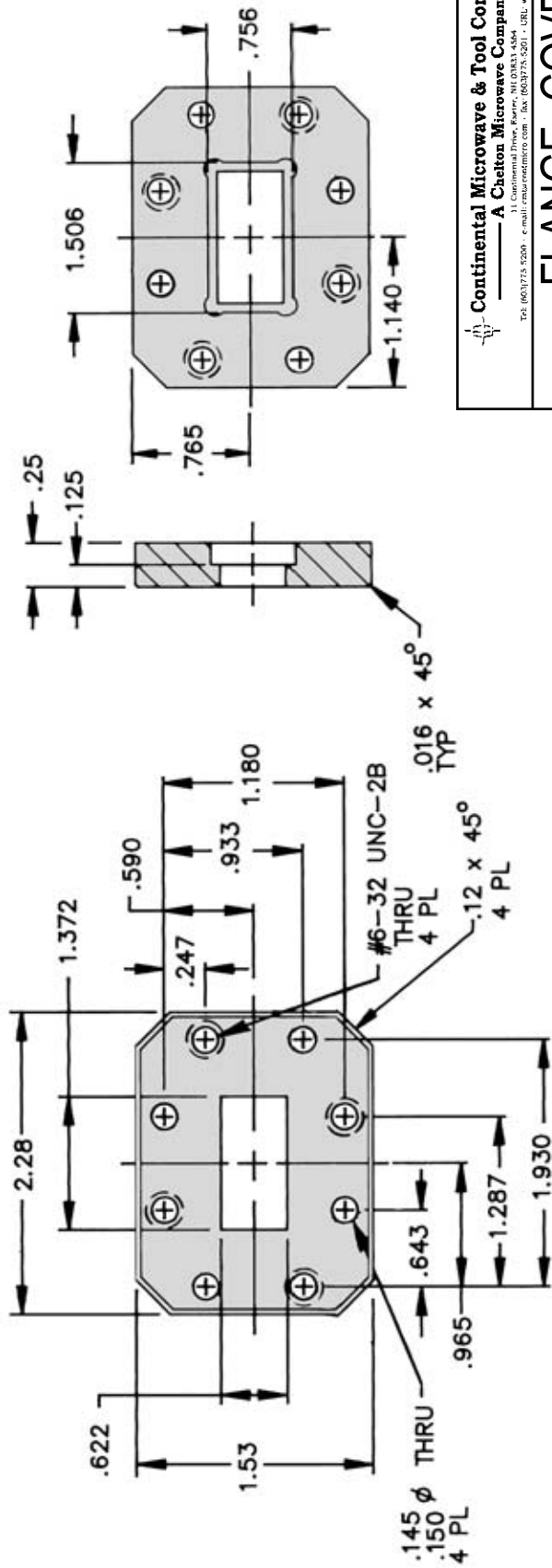





#10-32 UNC-2B  
6 HOLES EQ. SPACED (60° APART)  
ON A 2.750 φ B.C.

## FLANGE, GROOVED

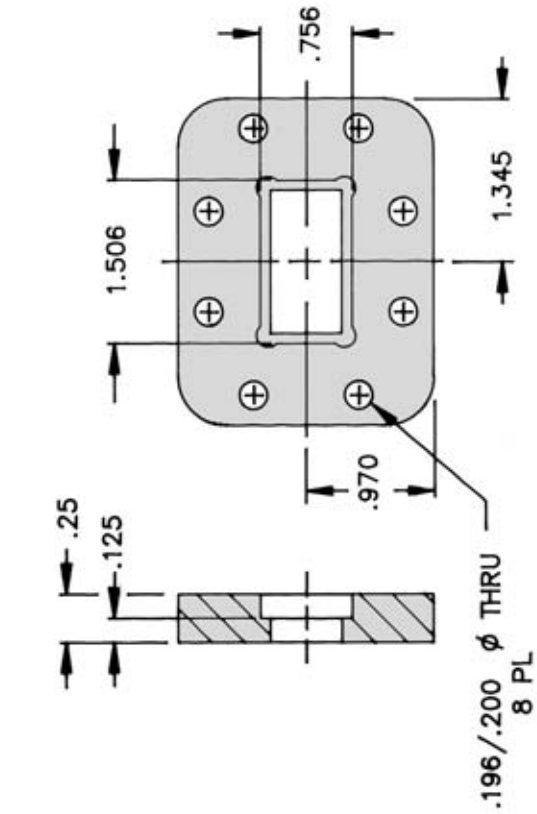
WR 137 (DES-8)



 **Continental Microwave & Tool Company, Inc.**  
A Chelton Microwave Company  
1 Continental Drive, Bldg. #103A33, Dover, MA 01929  
Tel: (603) 753-9300, e: cmt@continentalmicrowave.com, fax: (603) 753-9301, URL: www.contmtrco.com

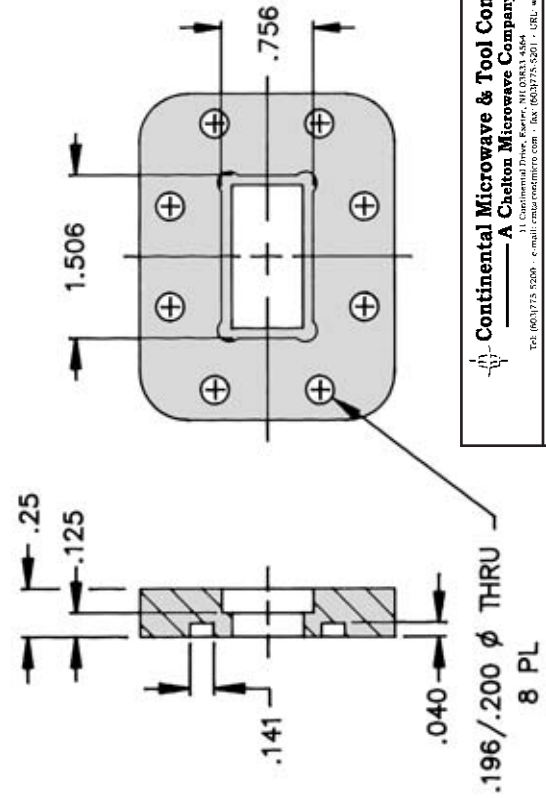
## FLANGE, COVER

CMR 137 (DES-21)



## FLANGE, COVER

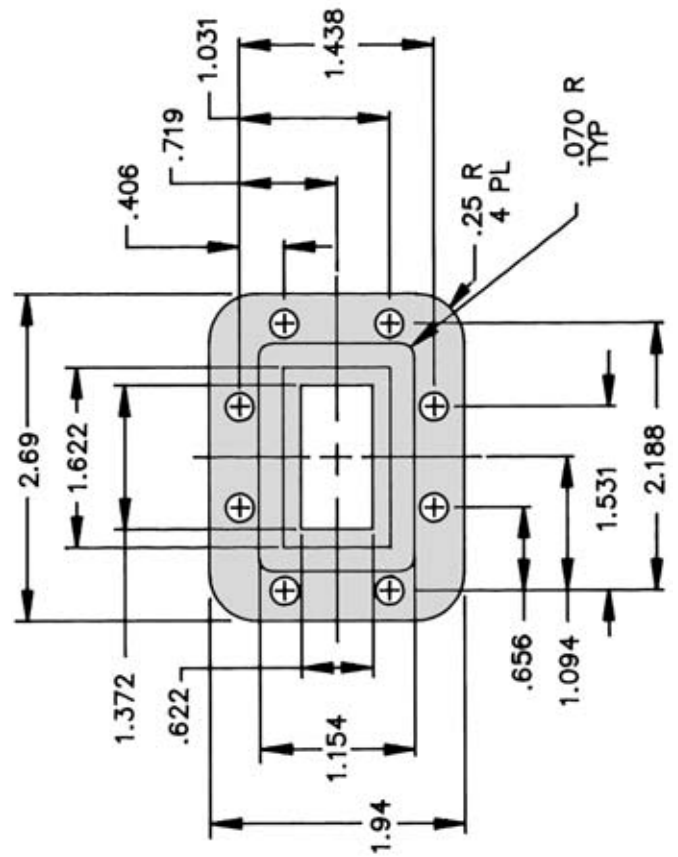
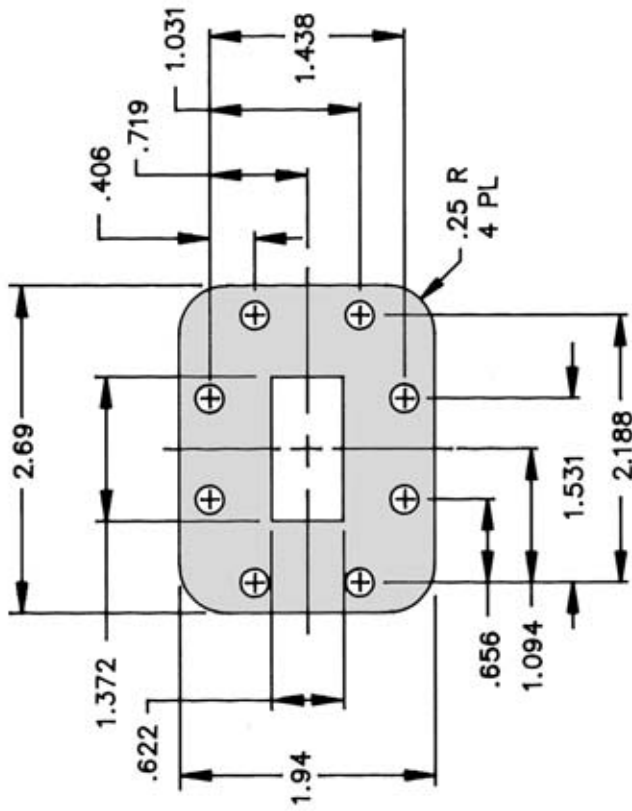
CPR 137 (DES-13)



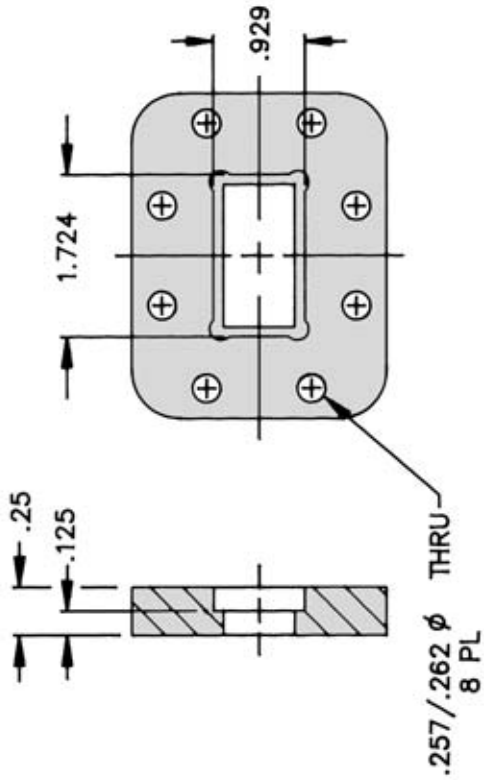
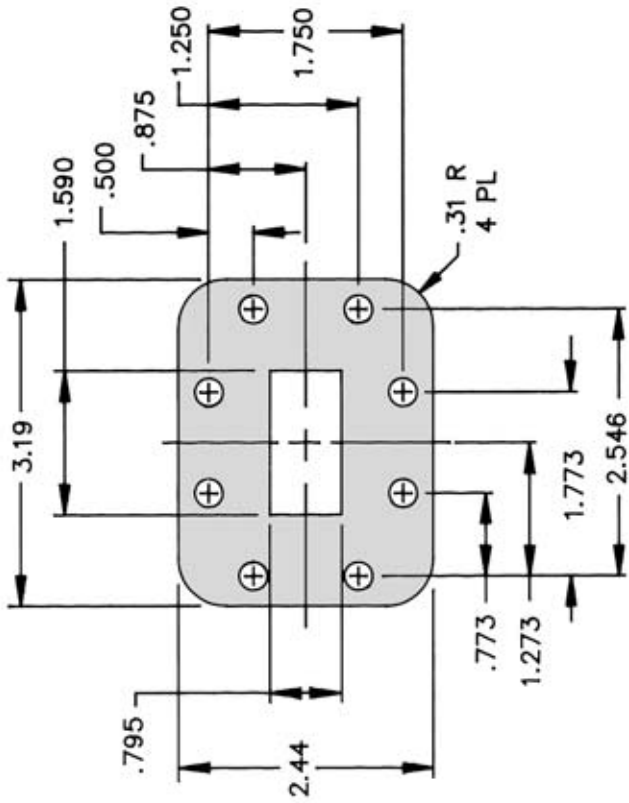
Continental Microwave & Tool Company, Inc.  
 A Chelton Microwave Company  
 1 Continental Drive, Dover, NH 03843 USA  
 Tel: (603) 753-9300, e: cmt@continentalmicrowave.com, fax: (603) 753-9321, URL: www.continentalmicrowave.com

## FLANGE, GROOVED

CPR 137 (DES-10)

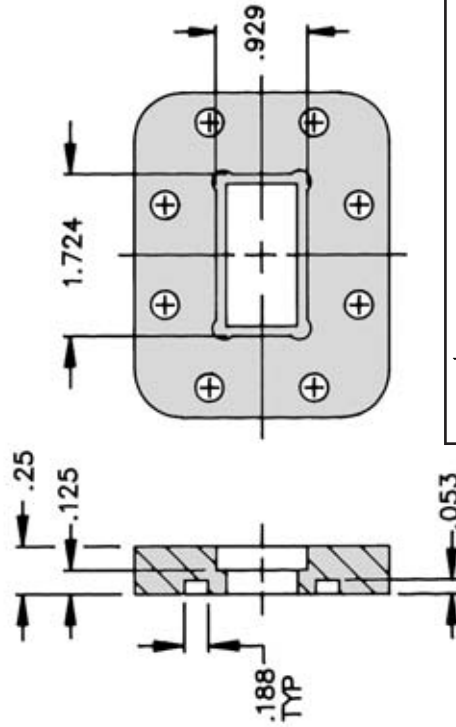
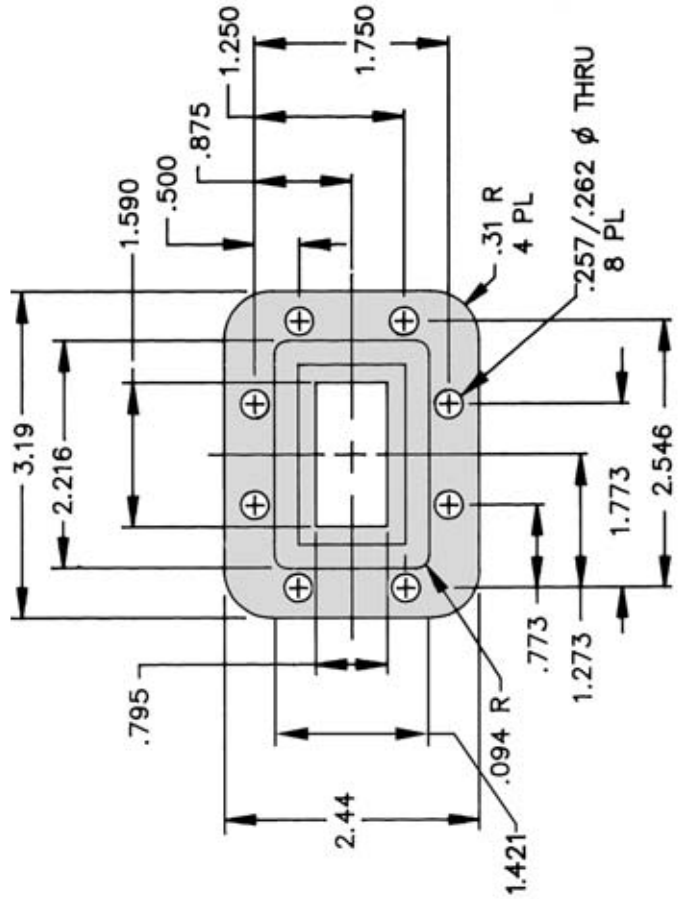






## FLANGE, COVER

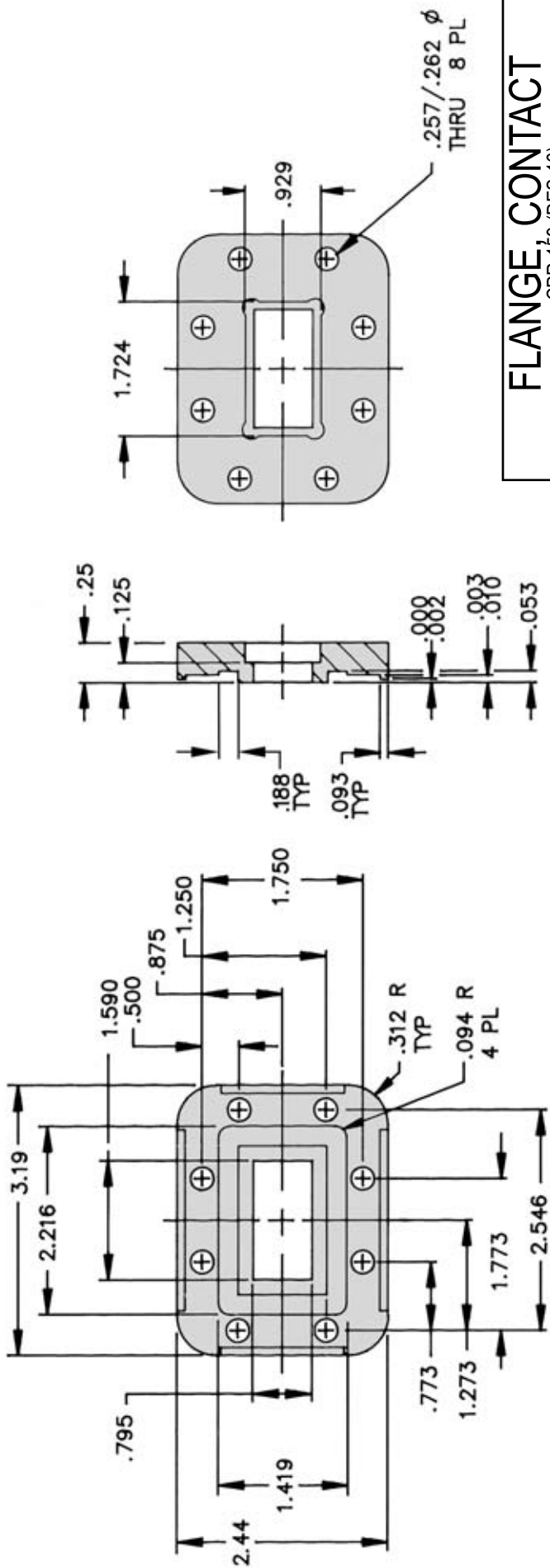
CPR 159 (DES-13)



Continental Microwave & Tool Company, Inc.  
 A Chelton Microwave Company  
 1 Continental Drive, Bower, MI 48133-3567  
 Tel: (601) 775-9300, e: cmail@continentalmicrowave.com, fax: (601) 775-9371, URL: www.continentalmic.com

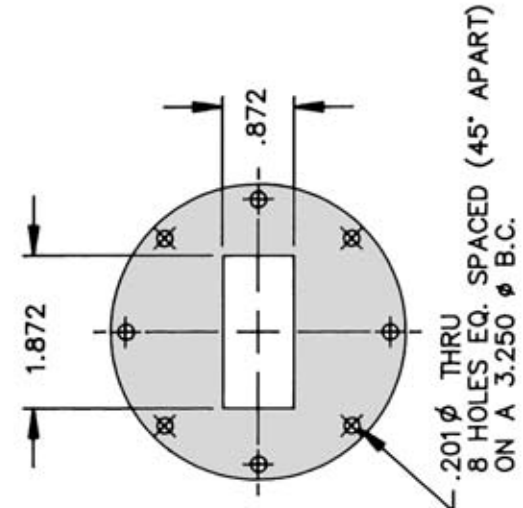
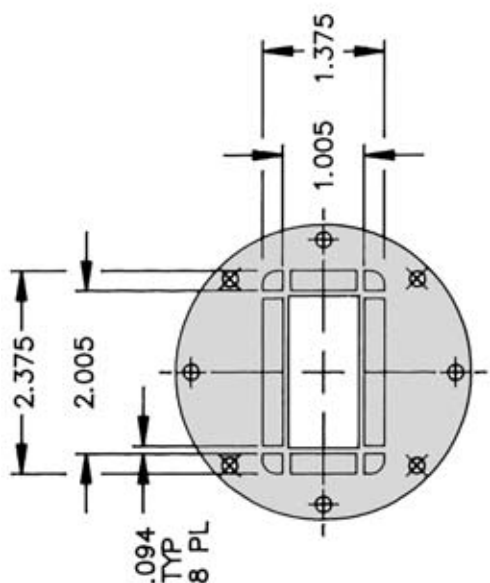
## FLANGE, GROOVED

CPR 159 (DES-10)



### FLANGE CONTACT

CPR 159 (DES-16)



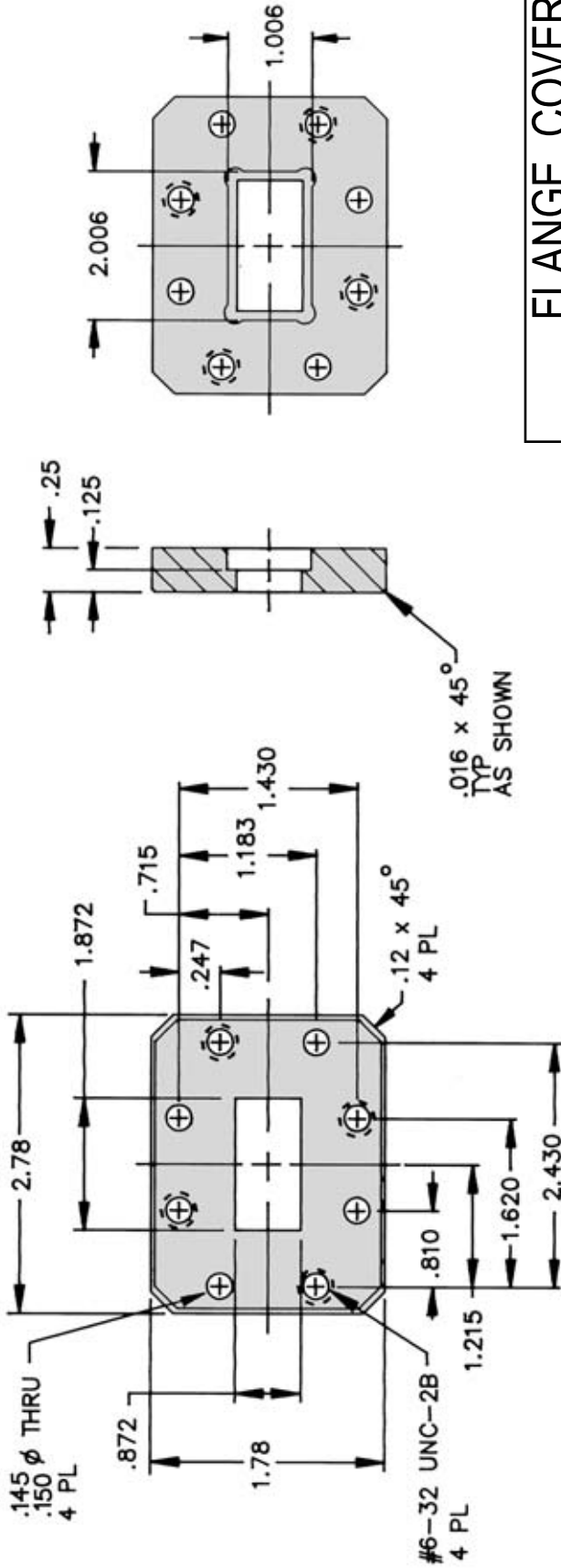
Continental Microwave & Tool Company, Inc.  
 A Chelton Microwave Company  
 11 Continental Drive, Bldg. #103, Waltham, MA 02453-5000  
 Tel: (603) 775-9200, e-mail: rps@continentalco.com, fax: (603) 775-9201, URL: www.continentalco.com

### FLANGE COVER

WR 187 (DES-1)

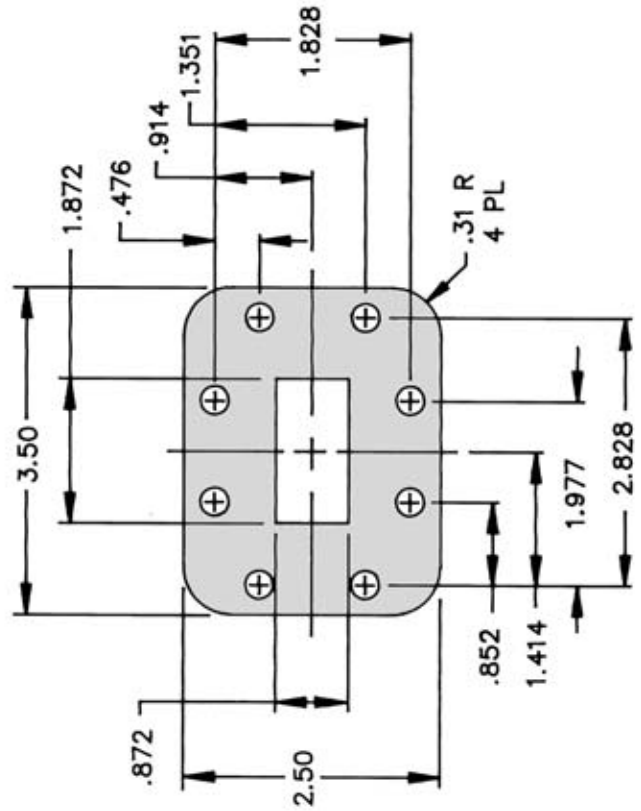






## FLANGE COVER

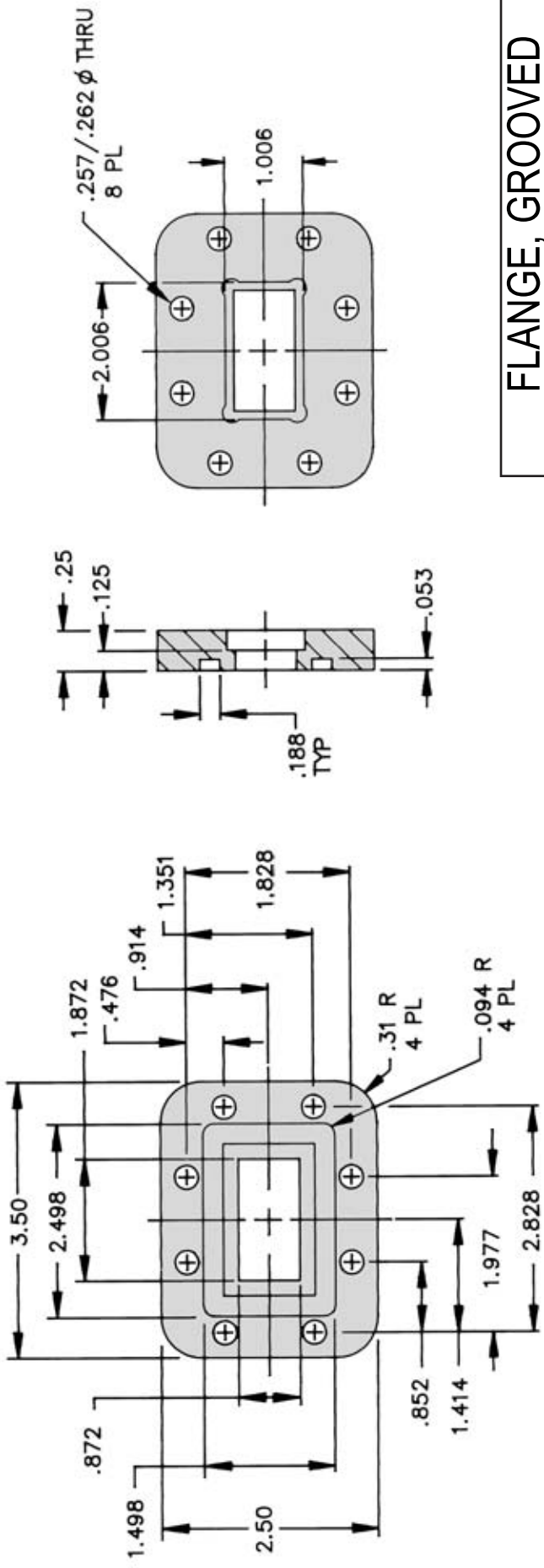
CMR 187 (DES-21)



## FLANGE COVER

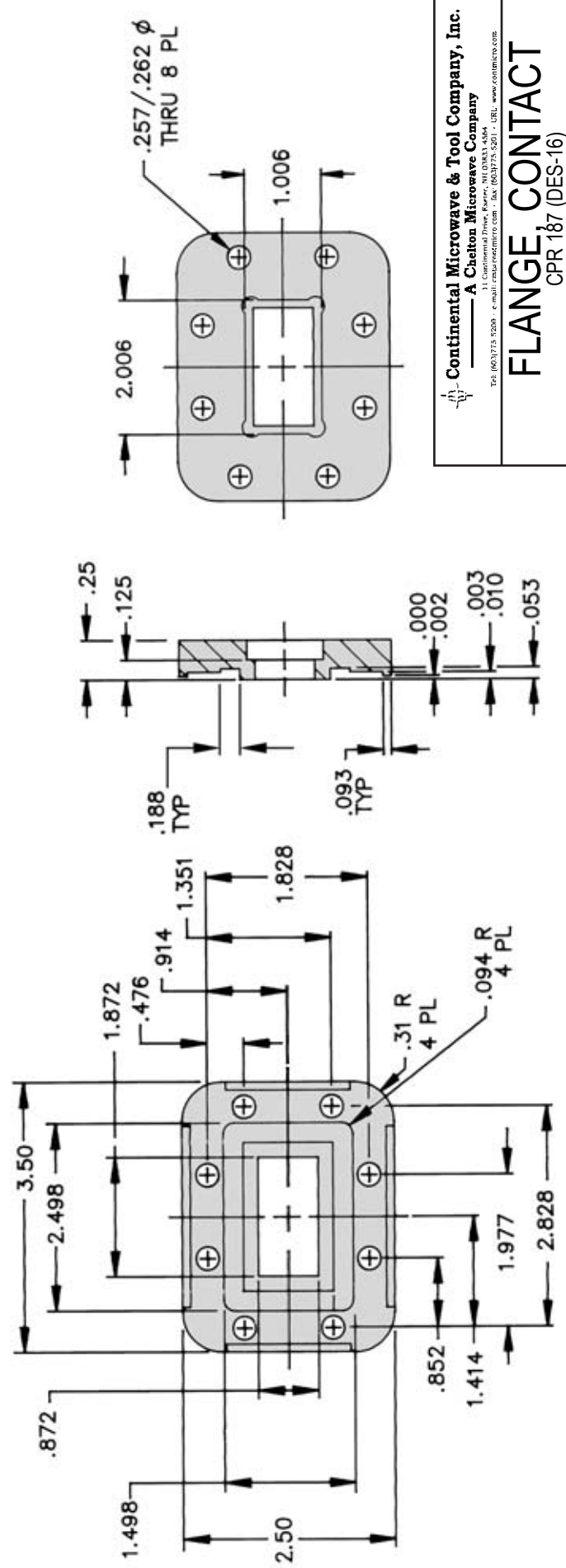
CPR 187 (DES-13)

Continental Microwave & Tool Company, Inc.  
A Chelton Microwave Company  
1 Continental Drive, Brierley, MA 01543-5009  
Tel: (603) 775-9300, e: ccmr@continentalmicrowave.com, fax: (603) 775-9321, URL: www.continentalmic.com



# FLANGE GROOVED

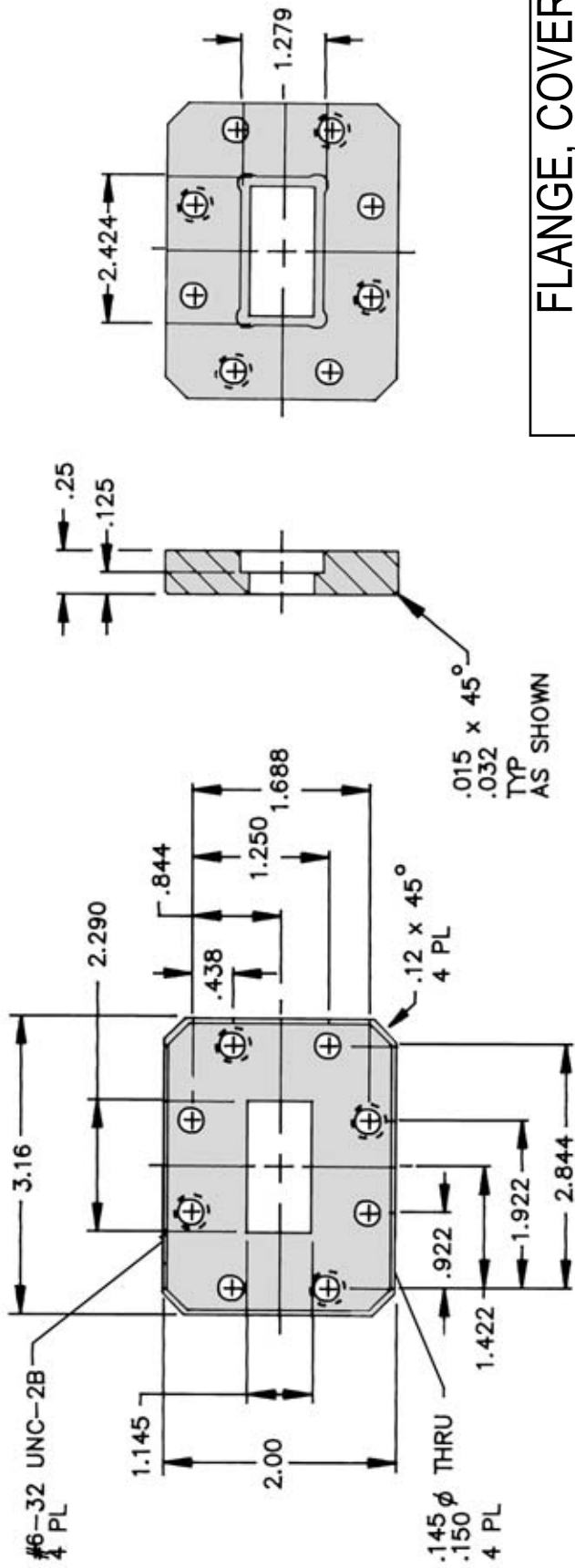
CPR 187 (DES-10)



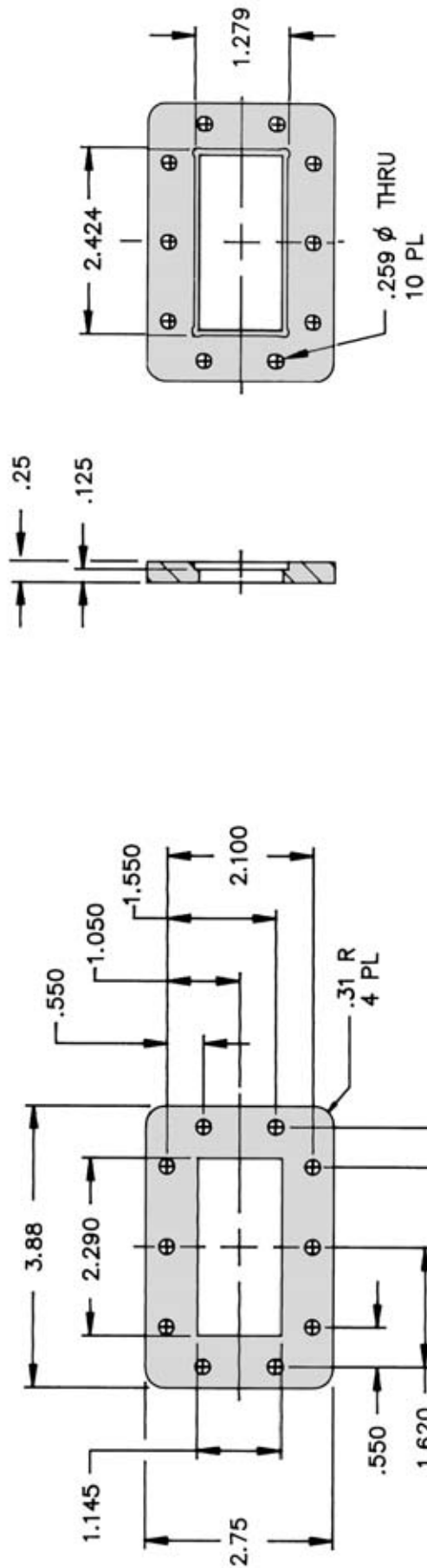
# FLANGE CONTACT

CPR 187 (DES-16)

Continental Microwave & Tool Company, Inc.  
 A Chelton Microwave Company  
 1 Continental Drive, Dover, NH 03843 USA  
 Tel: (603) 753-8200, e: cmt@continentalmicrowave.com, fax: (603) 753-8291, URL: www.continentalmicrowave.com

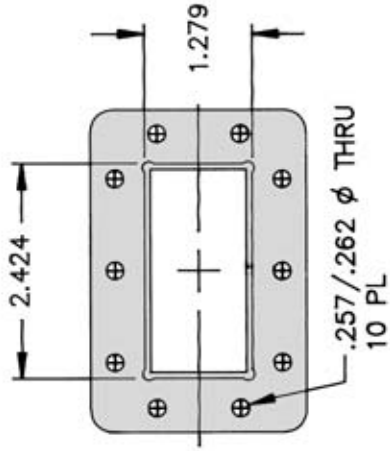
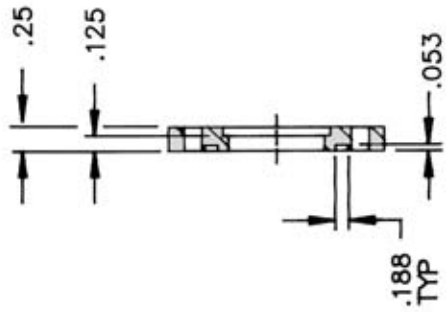
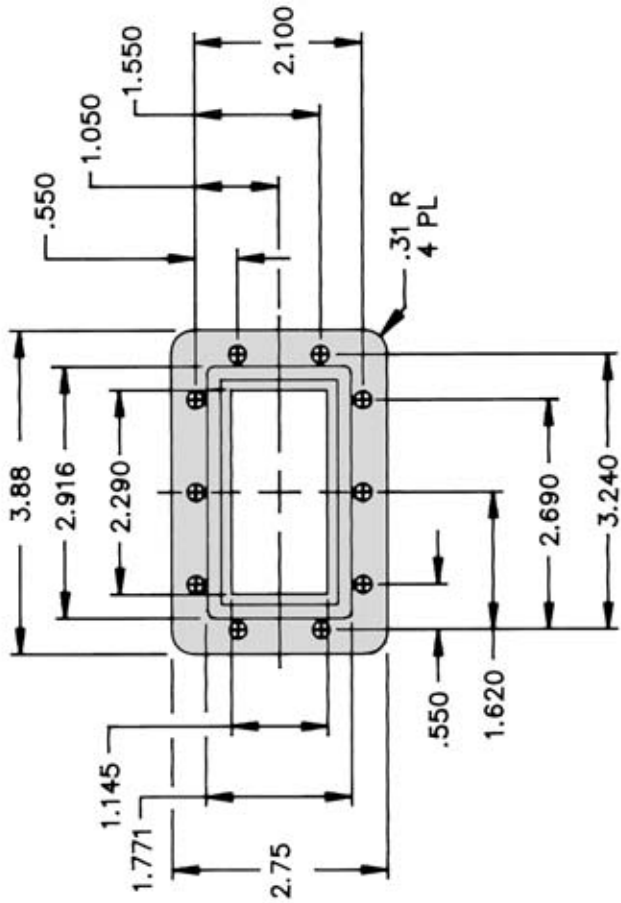


**FLANGE COVER**  
CMR 229 (DES-21)



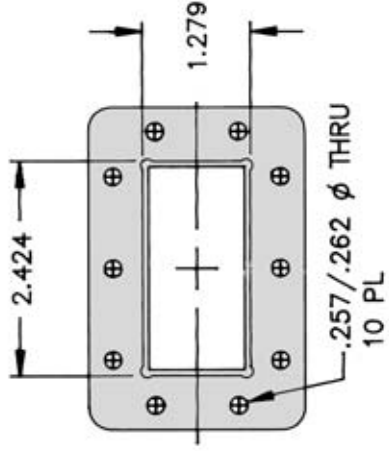
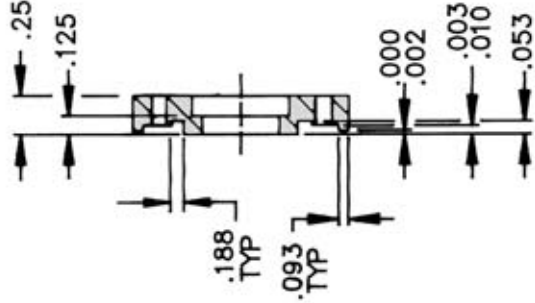
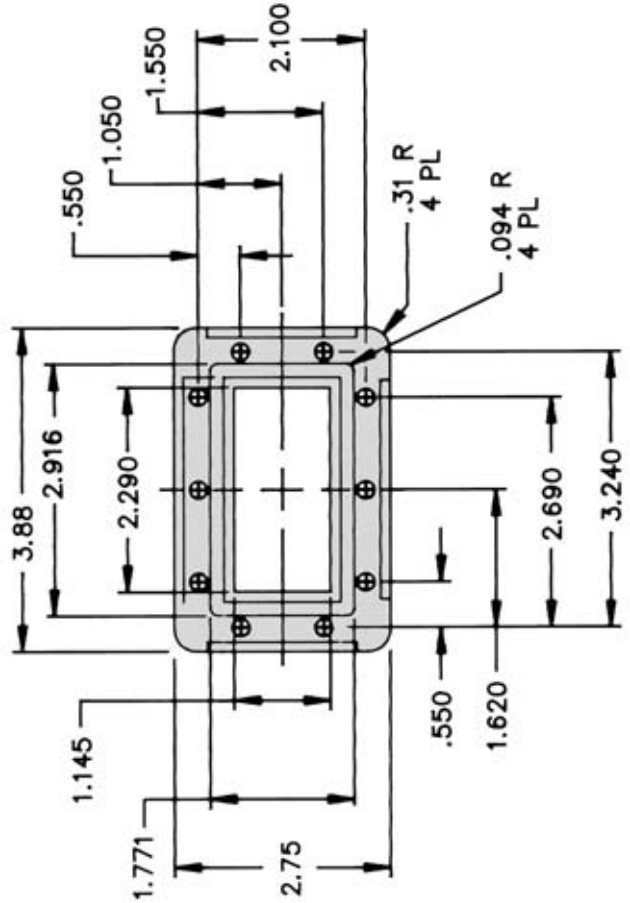
**FLANGE COVER**  
CPR 229 (DES-13)

Continental Microwave & Tool Company, Inc.  
A Chelton Microwave Company  
1 Continental Drive, Brierley, MI 48133-0001  
Tel: (601) 775-8200, e: cmail@continentalmicrowave.com, fax: (601) 775-8201, URL: www.continentalmicrowave.com



## FLANGE, GROOVED

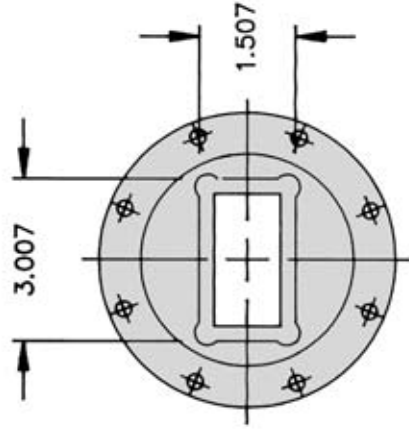
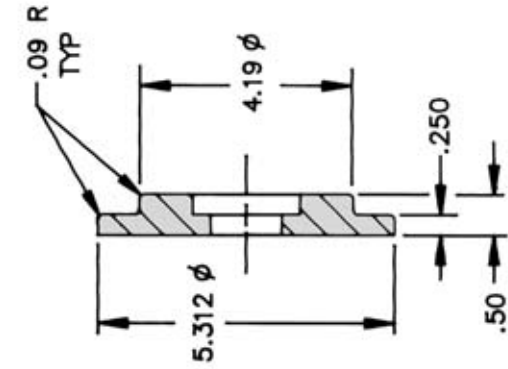
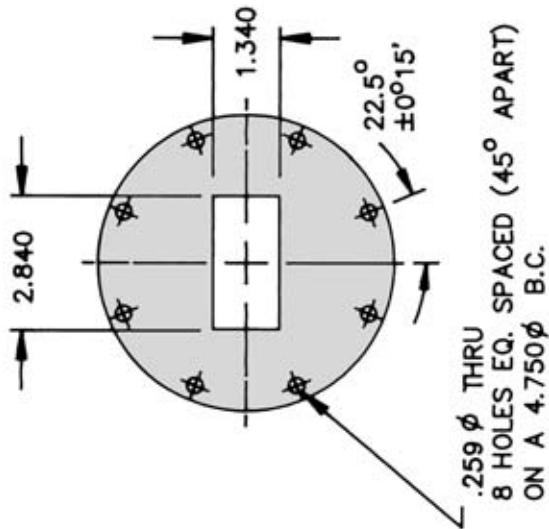
CPR 229 (DES-10)



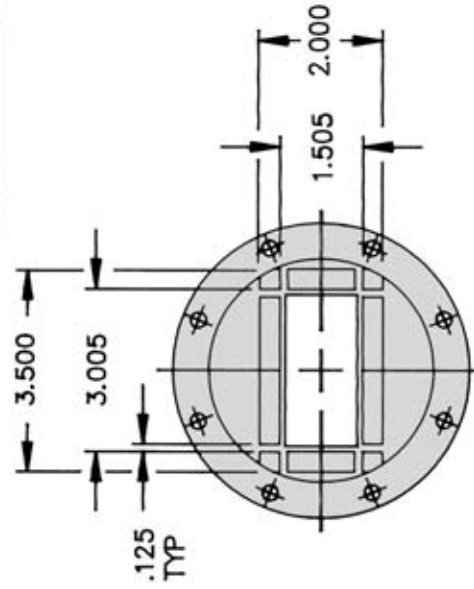
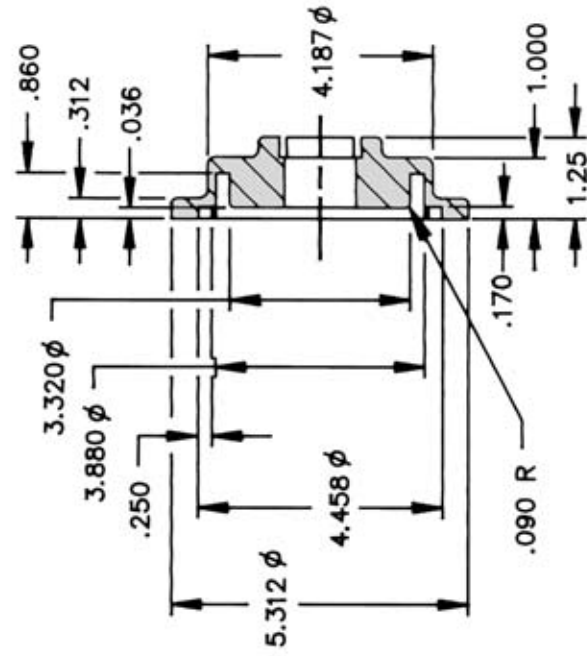
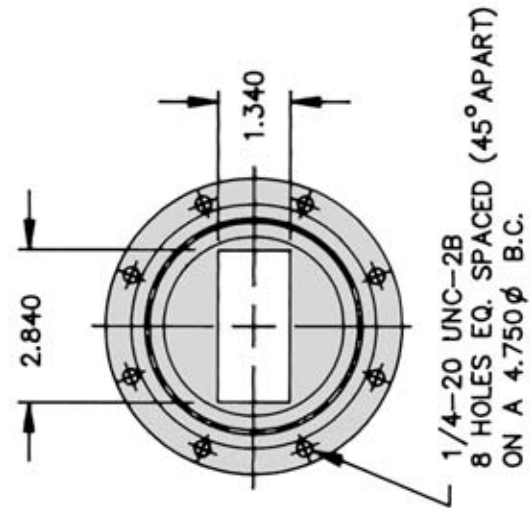
Continental Microwave & Tool Company, Inc.  
 A Chelton Microwave Company  
 11 Continental Drive, Brierley, NH 03843 USA  
 Tel: (603) 753-8300, e-mail: rmc@continentalco.com, fax: (603) 753-8321, URL: www.continentalco.com

## FLANGE CONTACT

CPR 229 (DES-16)

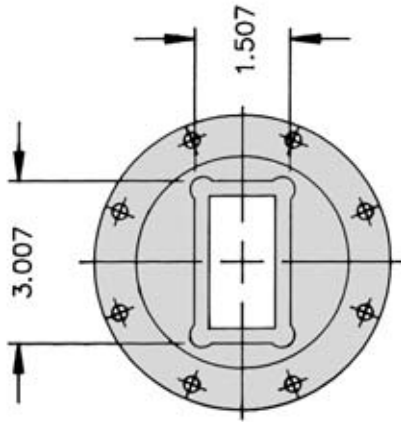
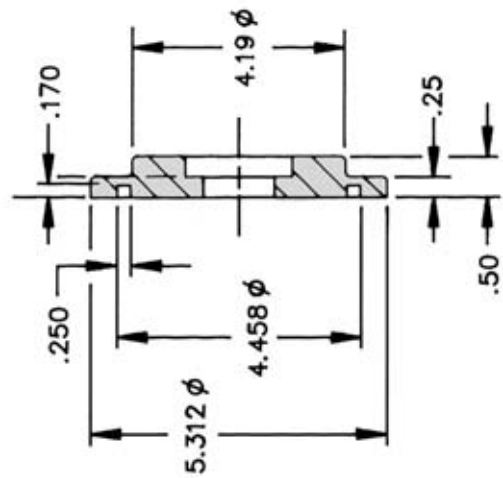
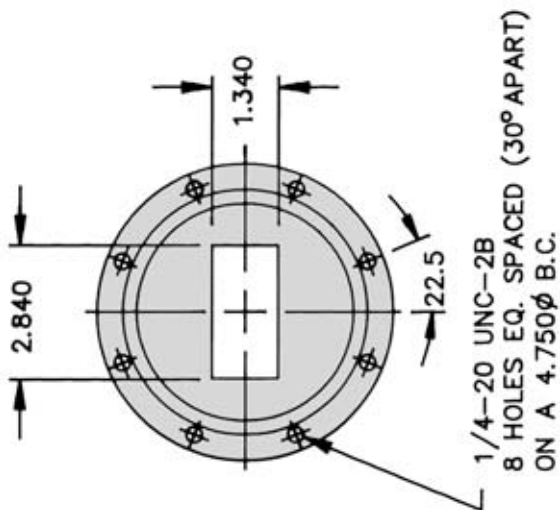


## FLANGE, COVER WR 284 (DES-1)



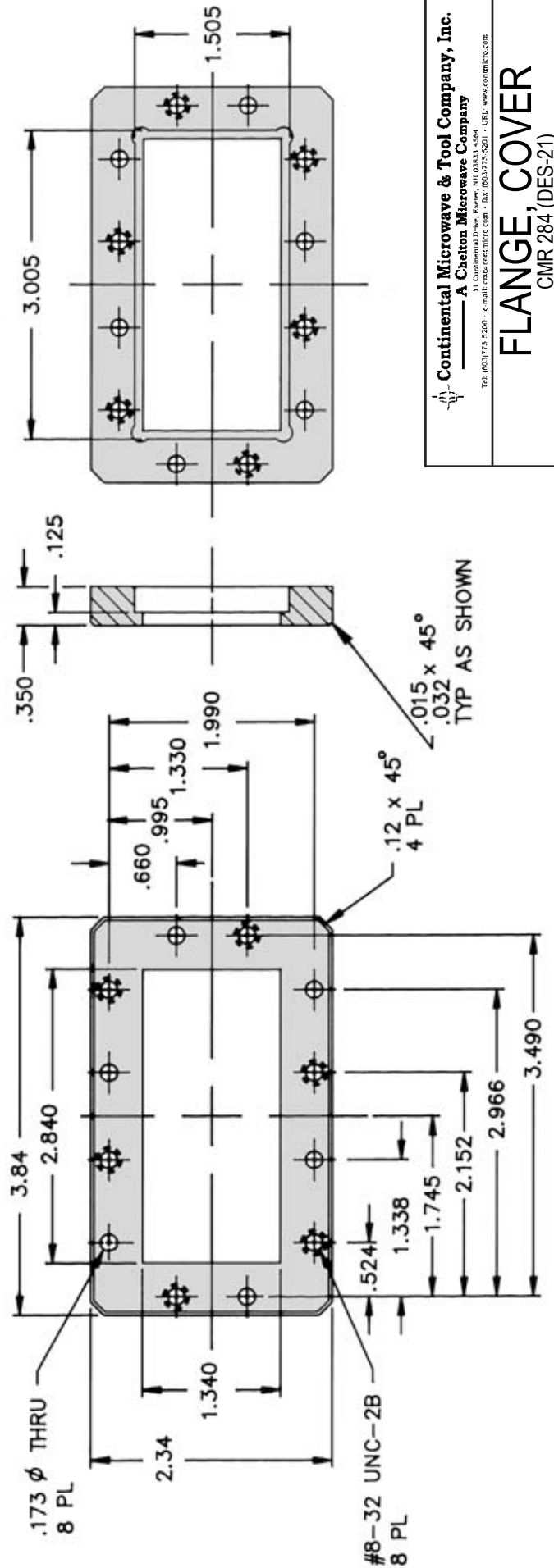
Continental Microwave & Tool Company, Inc.  
A Chelton Microwave Company  
1 Continental Drive, Tower, Millis, MA 01943-1506  
Tel: (603) 735-9300, e: cmt@continentalmco.com, fax: (603) 735-9301, URL: www.continentalmco.com

## FLANGE, CHOKE WR 284 (DES-5)



## FLANGE, GROOVED

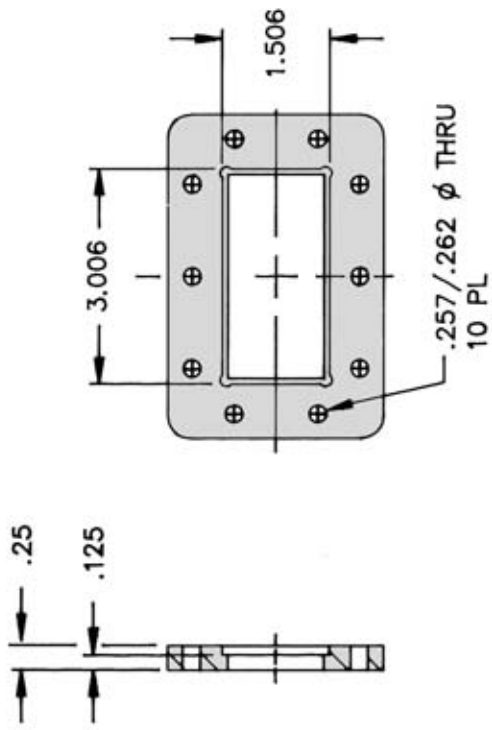
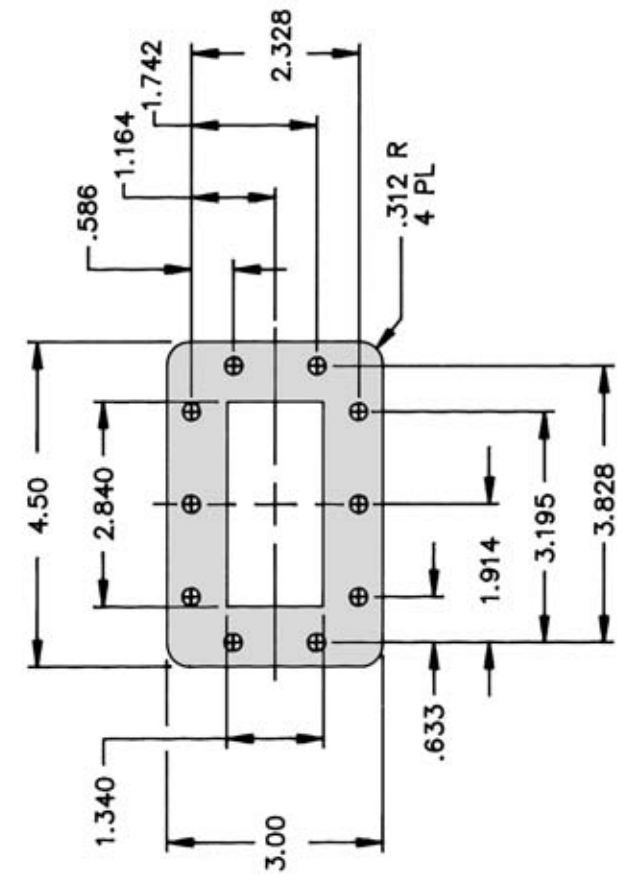
WR 284 (DES-8)



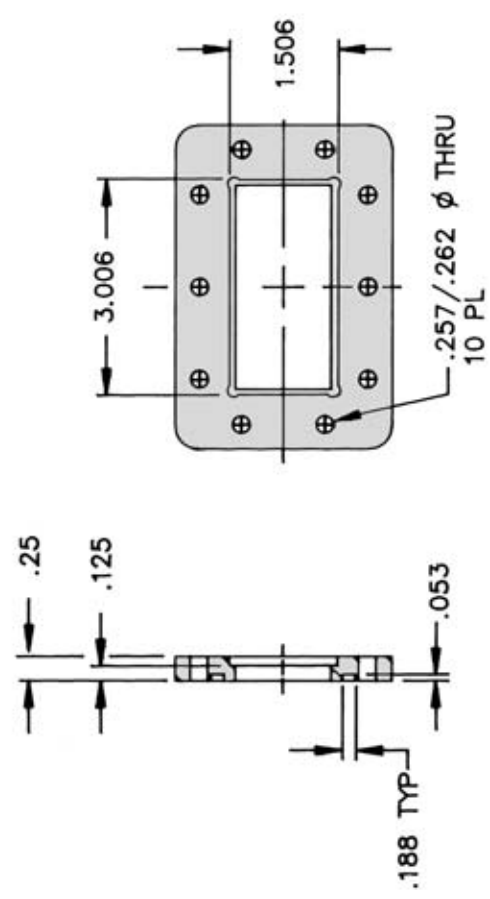
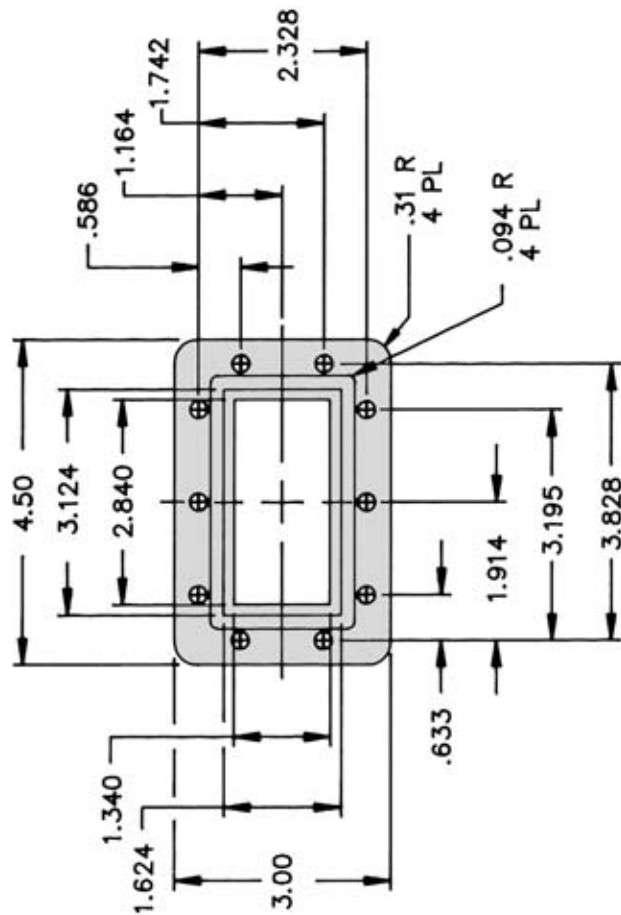
Continental Microwave & Tool Company, Inc.  
A Chelton Microwave Company  
1 Continental Drive, Tower, RI 02883-3004  
Tel: (603) 775-9300, e: cmt@cmrproducts.com, fax: (603) 775-9311, URL: www.cmrproducts.com

## FLANGE COVER

CMR 284 (DES-21)

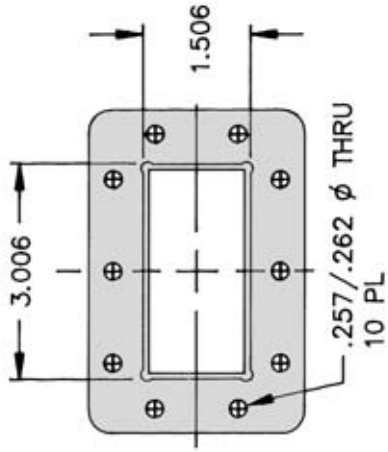
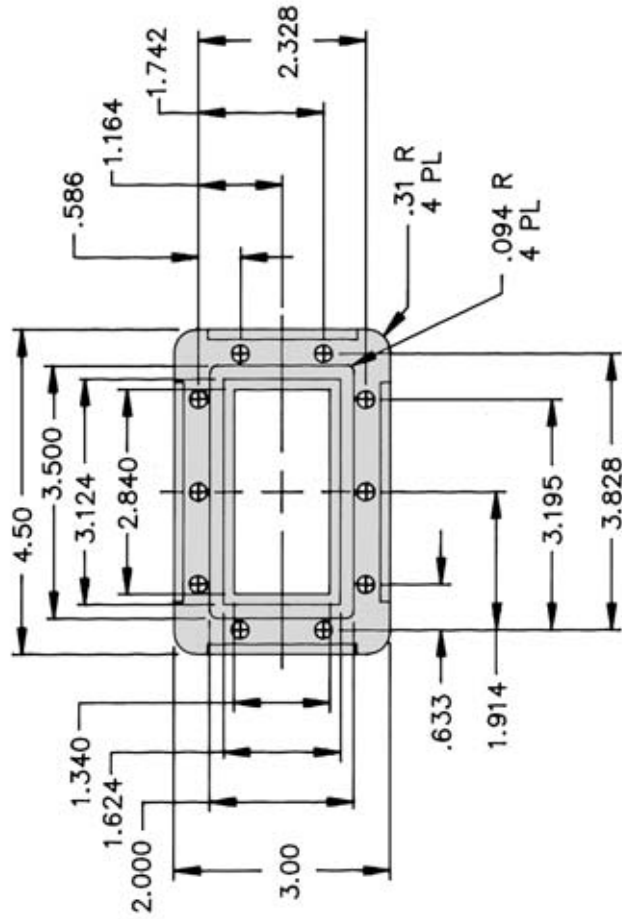


**FLANGE COVER**  
CPR 284 (DES-13)



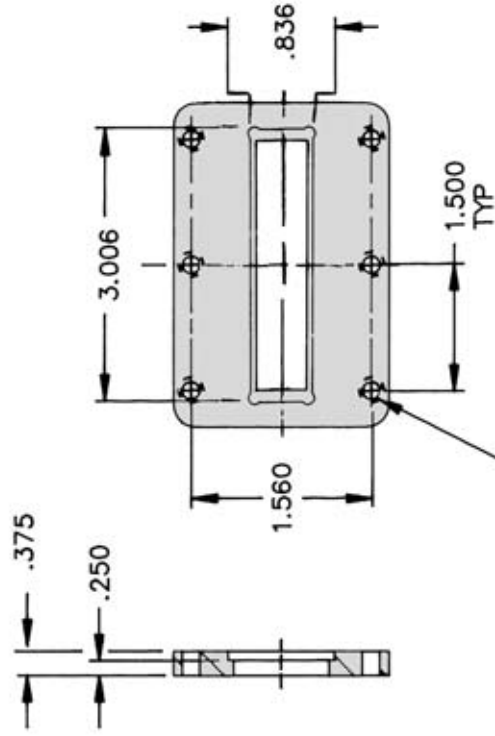
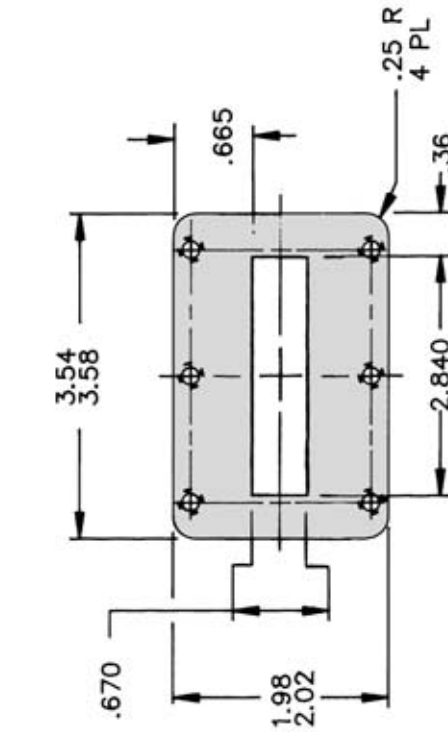
**FLANGE GROOVED**  
CPR 284 (DES-10)

Continental Microwave & Tool Company, Inc.  
A Chelton Microwave Company  
1 Continental Drive, Borer, NH 03343-0506  
Tel: (603) 775-9200, e: cmt@continentalmco.com, fax: (603) 775-9201, URL: www.continentalmco.com



## FLANGE CONTACT

CPR 284 (DES-16)

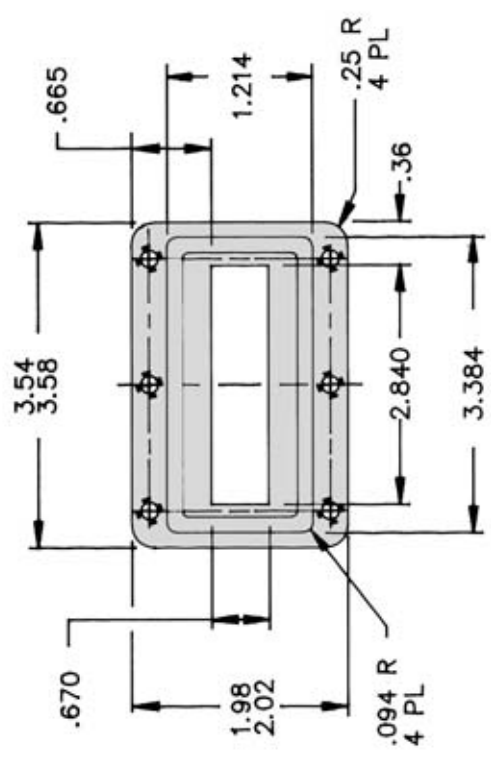
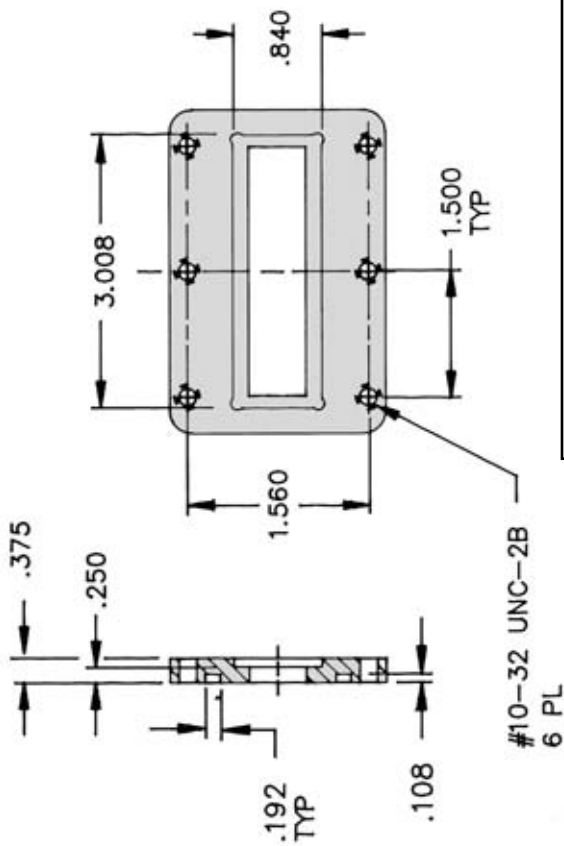


Continental Microwave & Tool Company, Inc.  
 A Chelton Microwave Company  
 11 Continental Drive, Broomfield, CO 80020  
 Tel: (800) 775-8200, e: cmt@continentalmco.com, fax: (303) 750-9291, URL: www.continmco.com

## FLANGE COVER

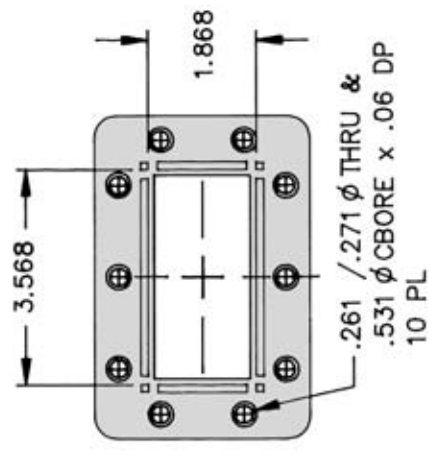
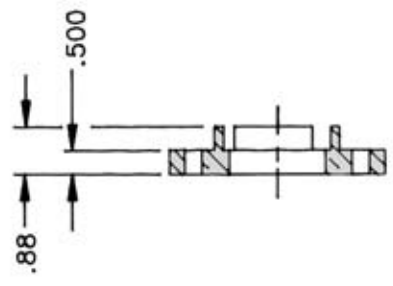
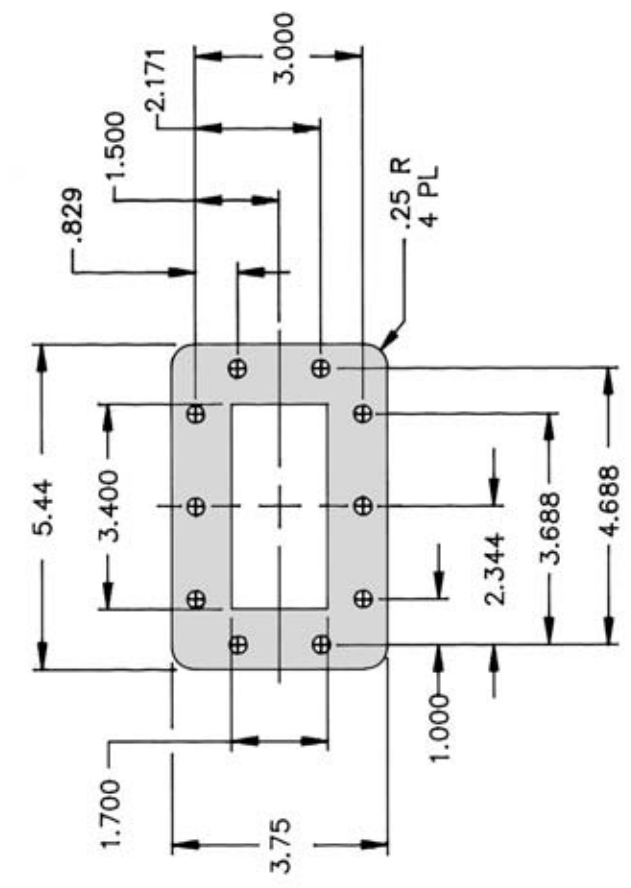
WR 284 R/H (DES-1)





# FLANGE, GROOVED

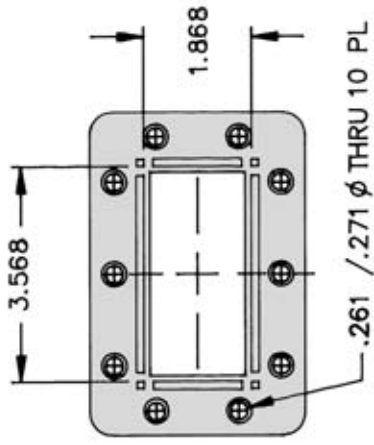
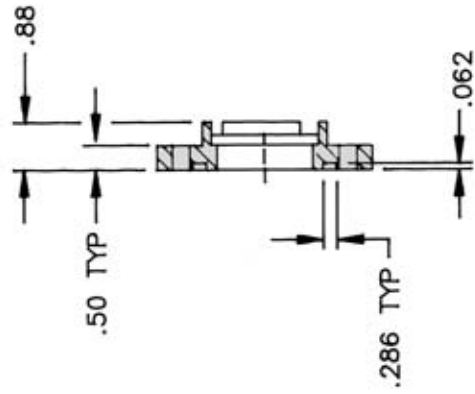
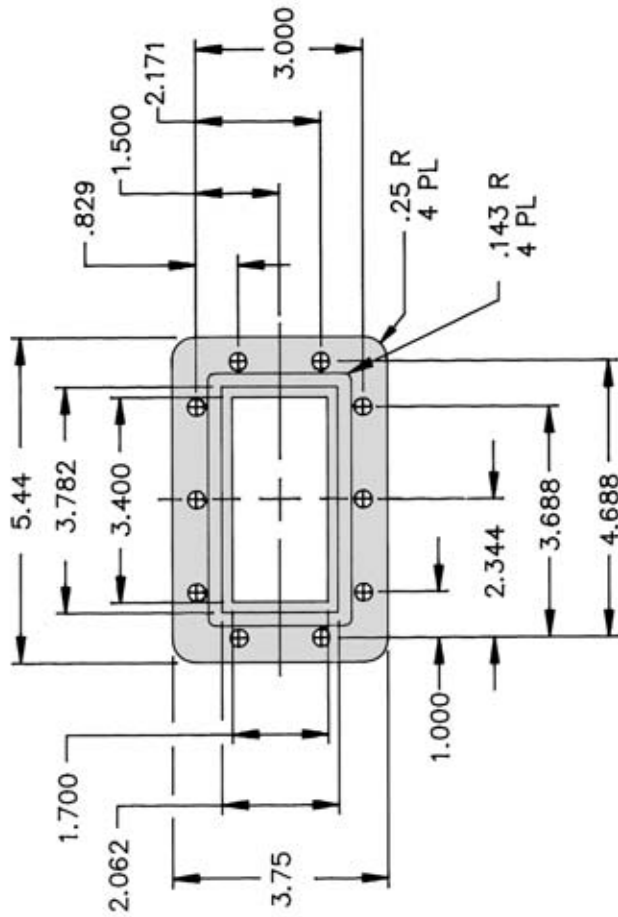
WR 284' R/H (DES-8R)



Continental Microwave & Tool Company, Inc.  
 A Chelton Microwave Company  
 11 Continental Drive, Brierley, MI 48133-6569  
 Tel: (601) 775-9200, e: cmi@continentalmicrowave.com, fax: (601) 775-9211, URL: www.continentalmic.com

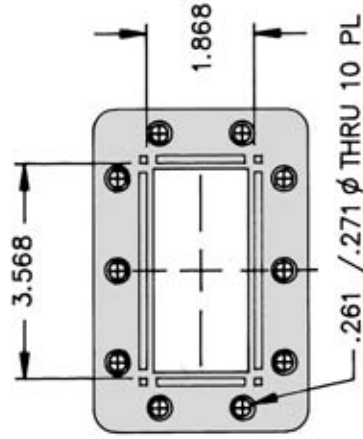
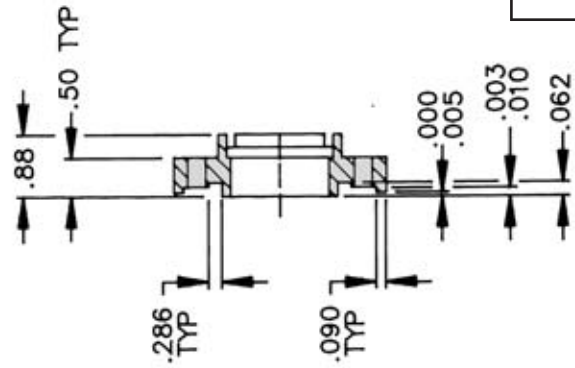
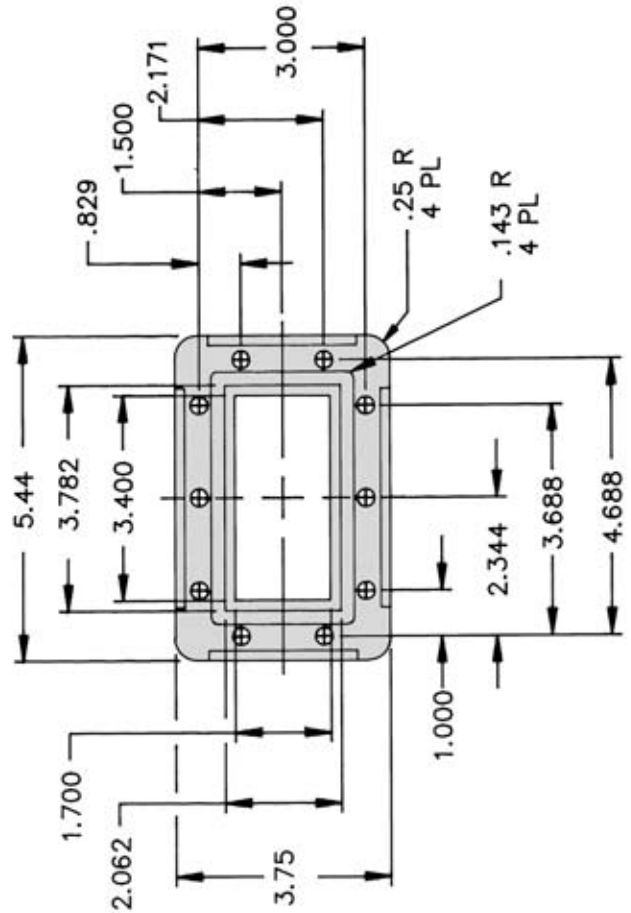
# FLANGE, COVER

CPR 340 (DES-13)



## FLANGE, GROOVED

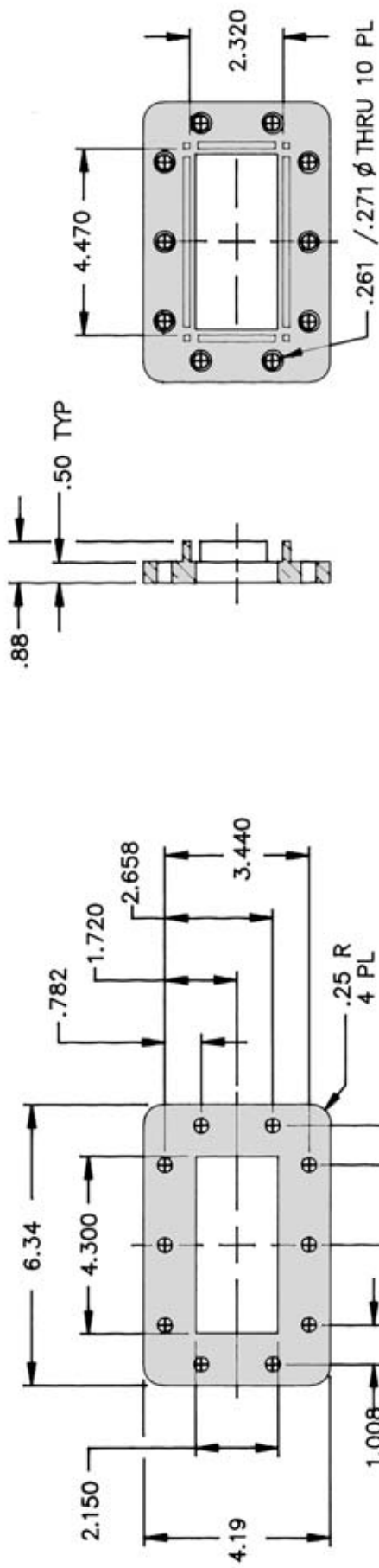
CPR 340 (DES-10)



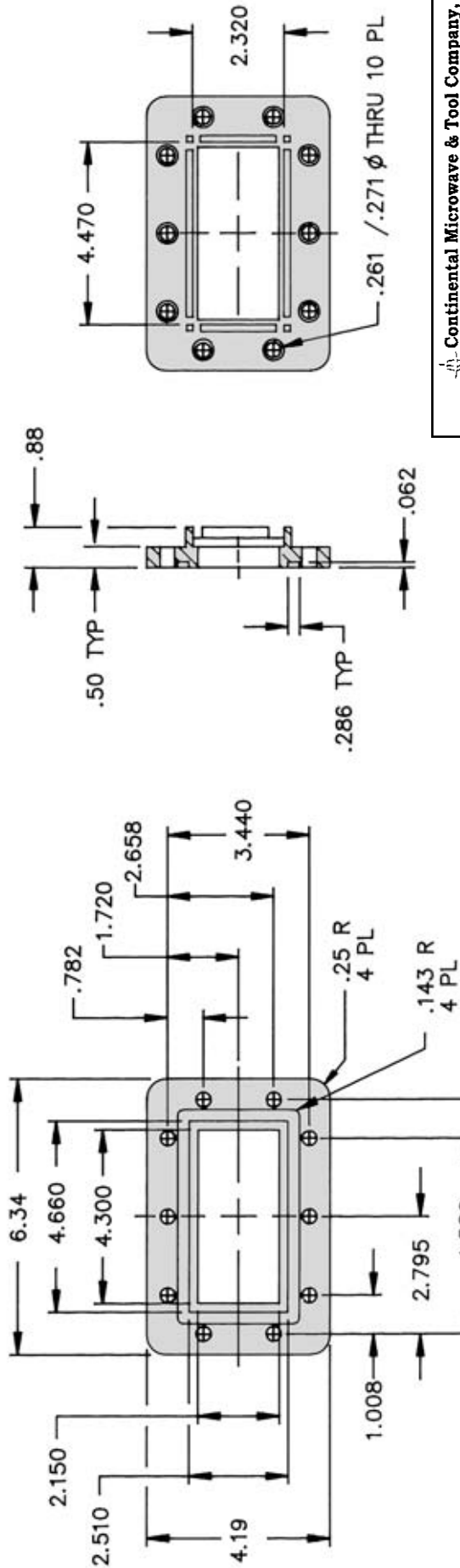
Continental Microwave & Tool Company, Inc.  
 A Chelton Microwave Company  
 11 Continental Drive, Dover, NH 03833-5004  
 Tel: (603) 753-8200, e: cmail@continentalmco.com, fax: (603) 753-8211, URL: www.continentalmco.com

## FLANGE, CONTACT

CPR 340 (DES-16)

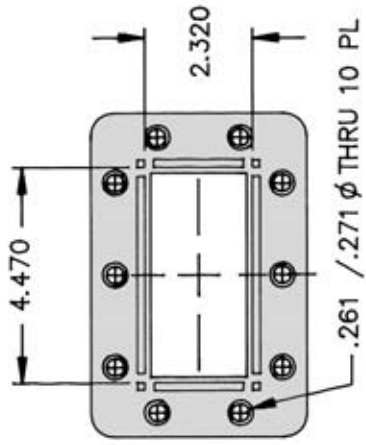
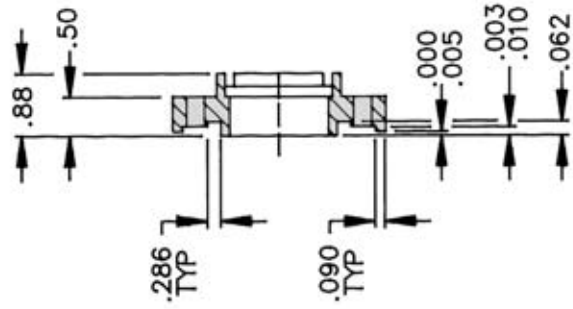
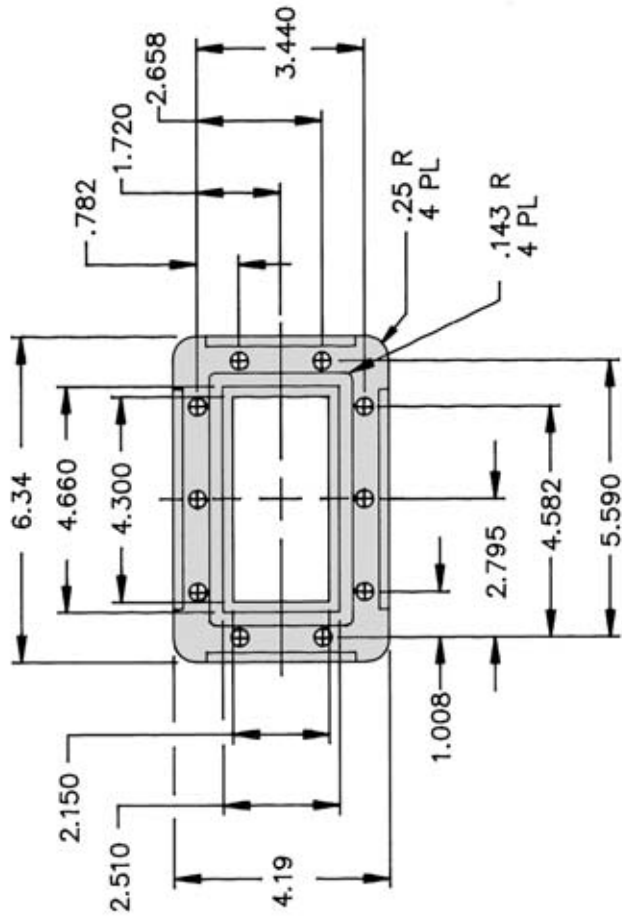


**FLANGE, COVER**  
CPR 430 (DES-13)



**FLANGE, GROOVED**  
CPR 430 (DES-10)

Continental Microwave & Tool Company, Inc.  
A Chelton Microwave Company  
1 Continental Drive, Brierley, MI 48343-6566  
Tel: (601) 775-8200, e: cmt@continentalmco.com, fax: (601) 775-8211, URL: www.continentalmco.com



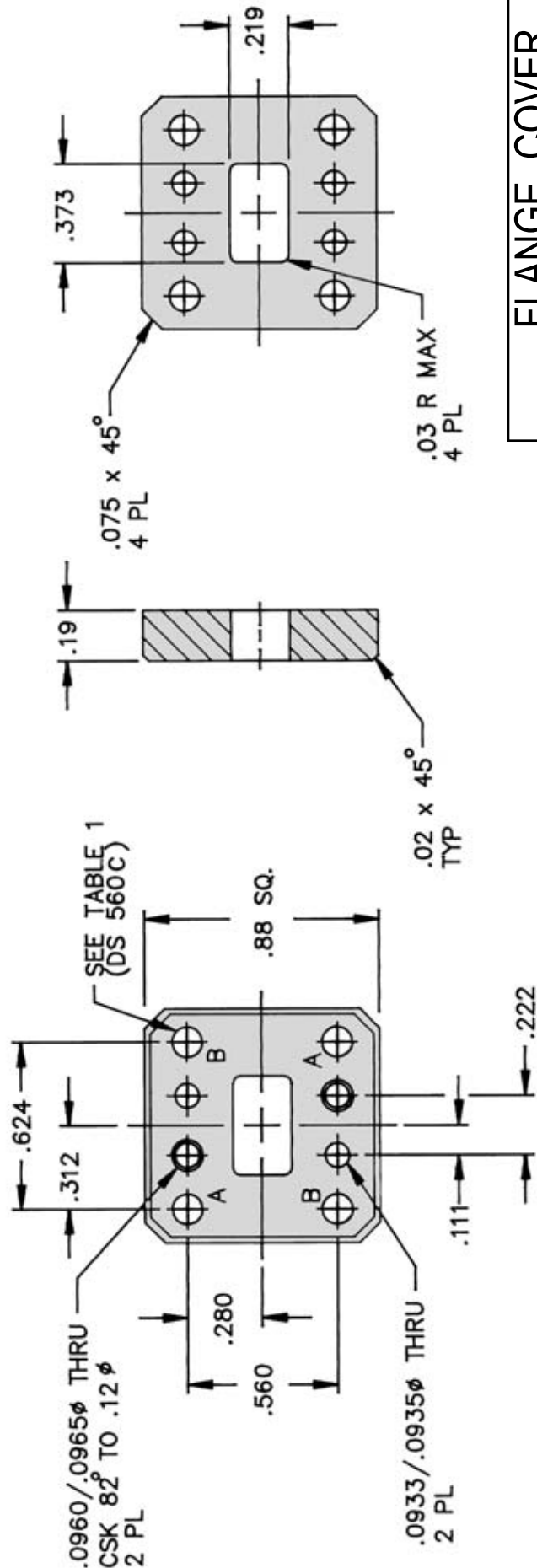
## FLANGE CONTACT

CPR 430 (DES-16)

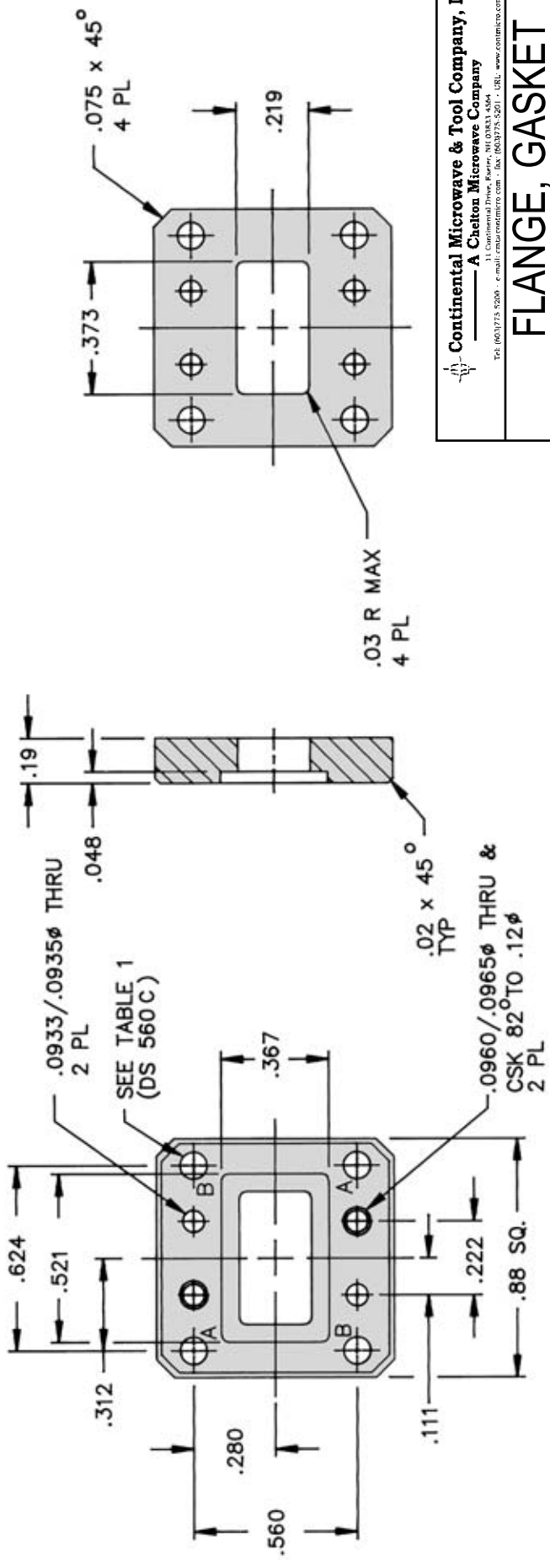
## DOUBLE RIDGE HOLE DIMENSIONS

TABLE 1

WAVEGUIDE SIZE	HOLE A	HOLE B
WRD 180	#4-40 UNC-2B	.116 / .119 Ø THRU
WRD 110		
WRD 750	#6-32 UNC-2B	.144 / .147 Ø THRU
WRD 650		
WRD 500		
WRD 475	#8-32 UNC-2B	.169 / .172 Ø THRU
WRD 350		
WRD 250		

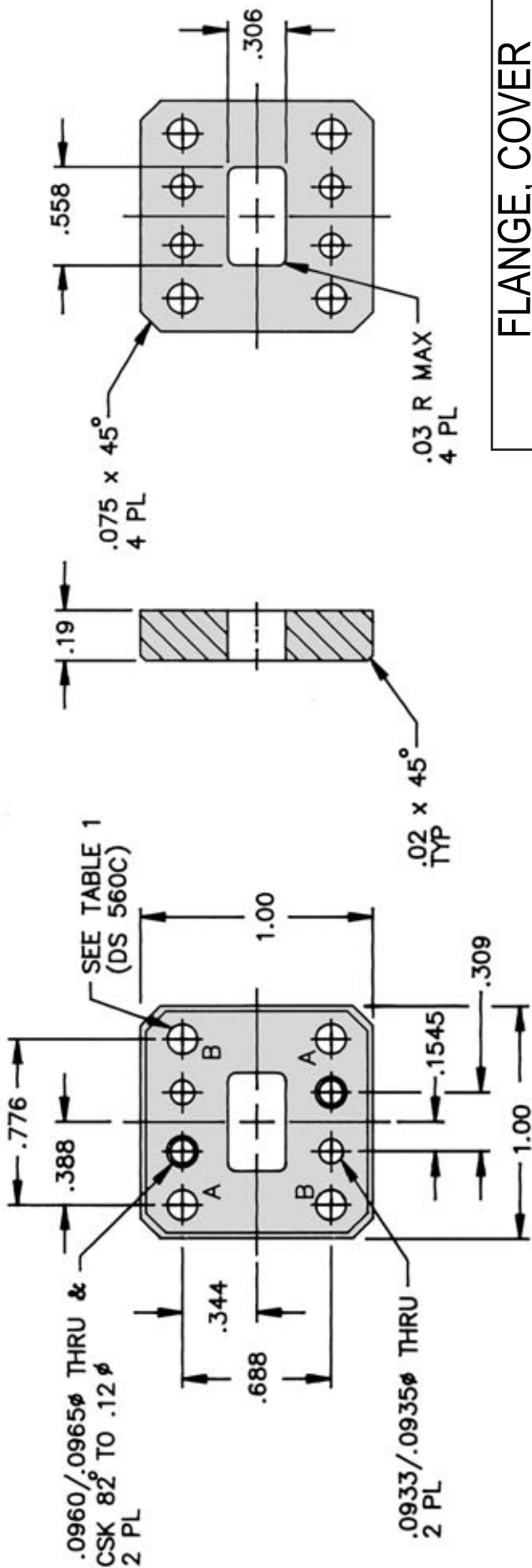


**FLANGE COVER**  
WRD 180-THRU TYPE (DES-1-C)



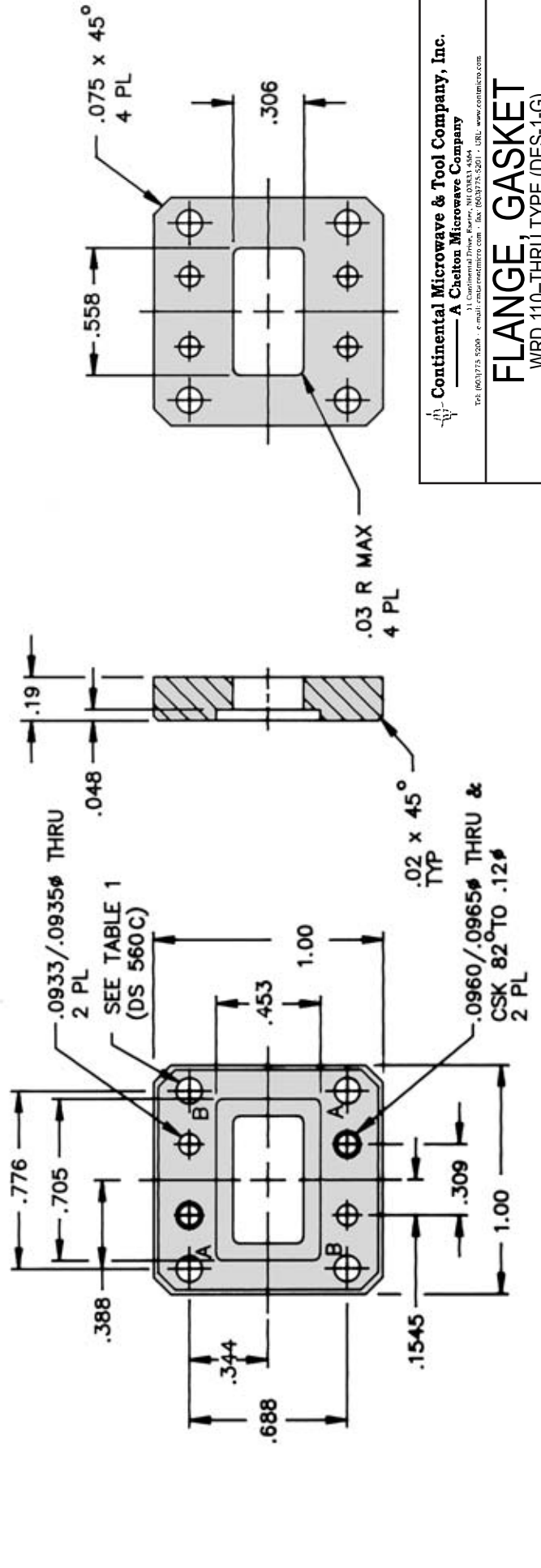
**FLANGE GASKET**  
WRD 180-THRU TYPE (DES-1-G)

Continental Microwave & Tool Company, Inc.  
A Chelton Microwave Company  
1 Continental Drive, Bower, MI 48343-6566  
Tel: (601) 775-3200, e: cmail@continentalmco.com, fax: (601) 775-3201, URL: www.continentalmco.com



## FLANGE COVER

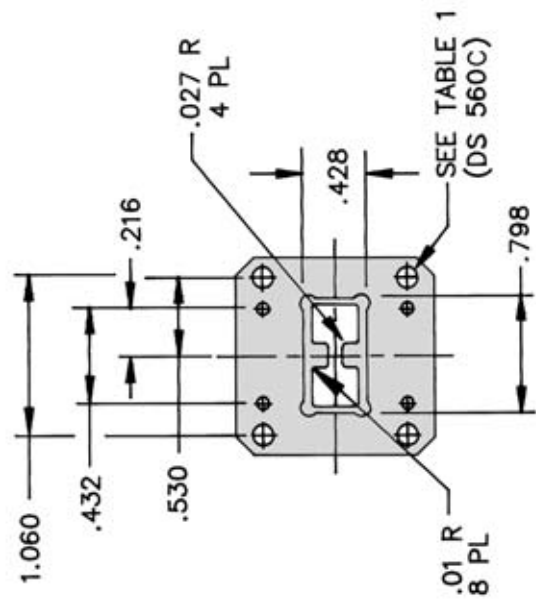
WRD 110-THRU TYPE (DES-1-C)



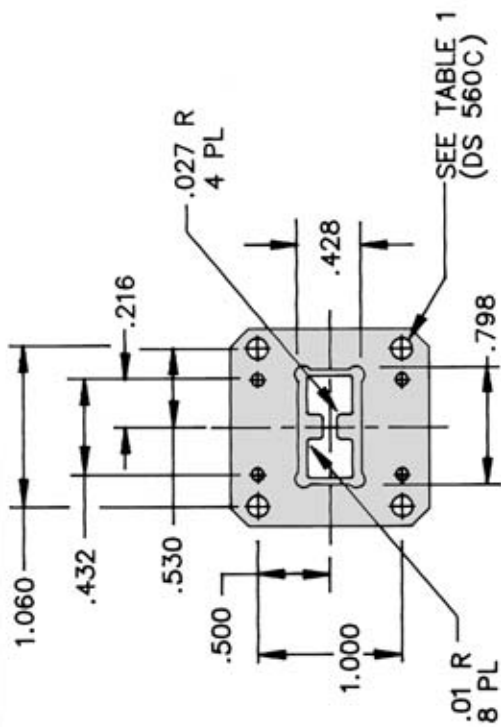
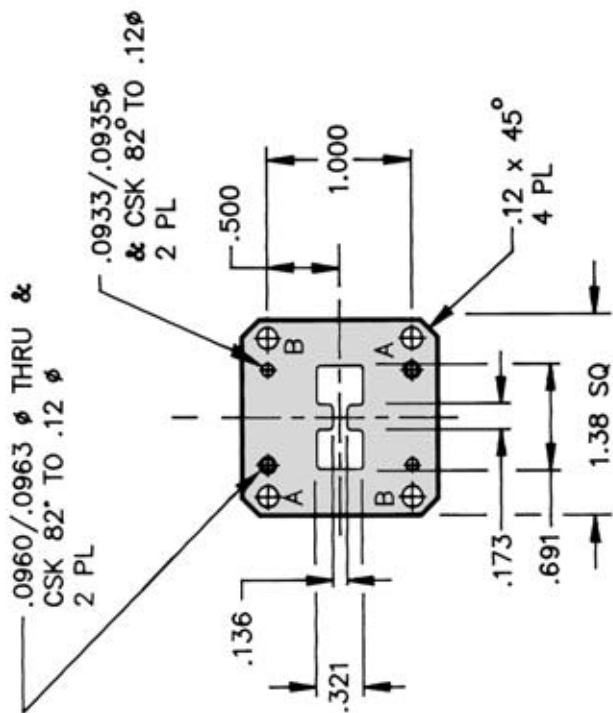
Continental Microwave & Tool Company, Inc.  
 A Chelton Microwave Company  
 1 Commercial Drive, Westborough, MA 01581  
 Tel: (603)775-9200, e-mail: [contmic@contmic.com](mailto:contmic@contmic.com), URL: [www.contmic.com](http://www.contmic.com)

## FLANGE GASKET

WRD 110-THRU TYPE (DES-1-G)

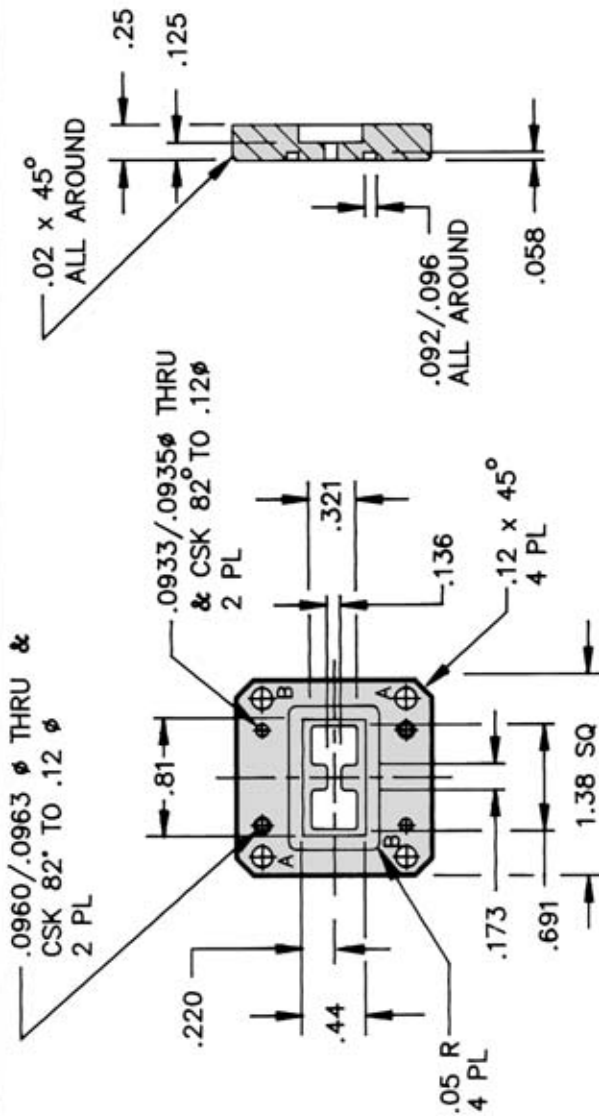


### FLANGE COVER WRD 750 (DES-1-C)



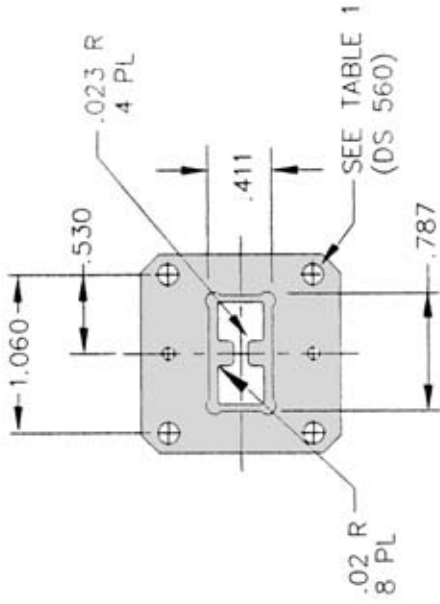
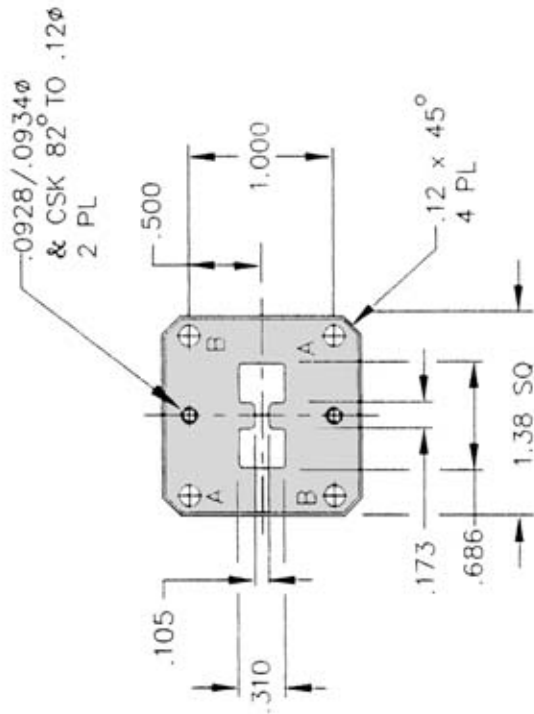
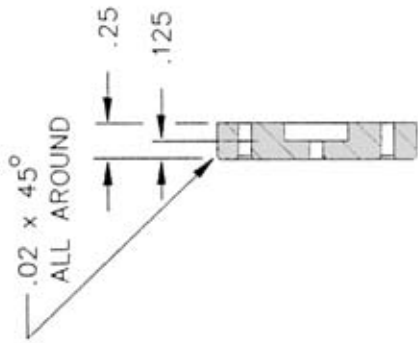
Continental Microwave & Tool Company, Inc.  
A Chelton Microwave Company  
1 Continental Drive, Brierley, MI 48133-6509  
Tel: (601) 775-9200, e: cmail@continentalmco.com, fax: (601) 775-9291, URL: www.continentalmco.com

### FLANGE GASKET WRD 750 (DES-1-G)



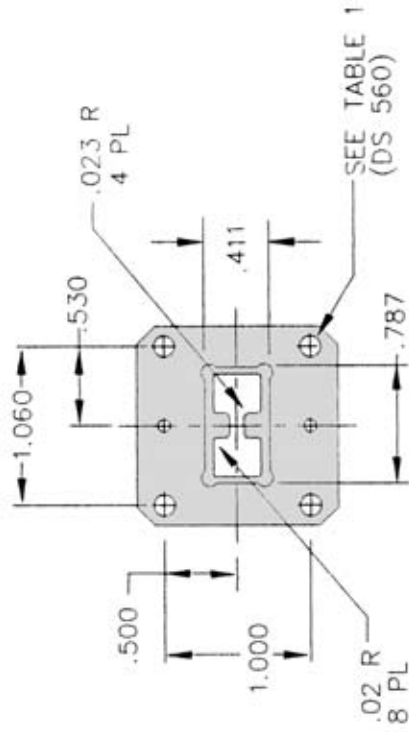
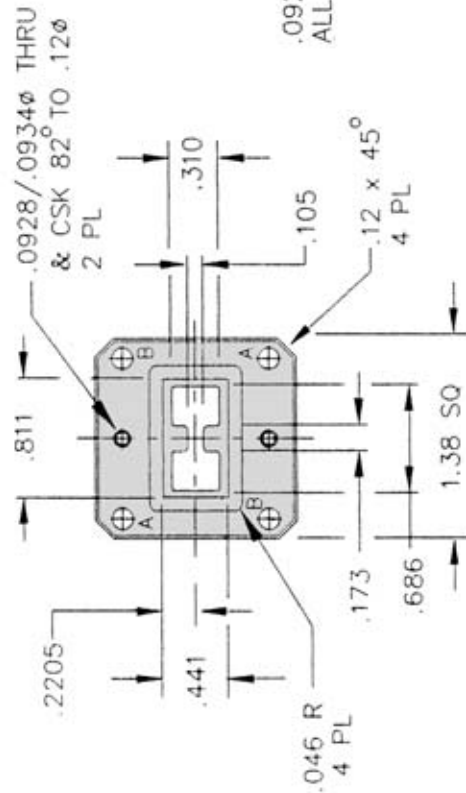
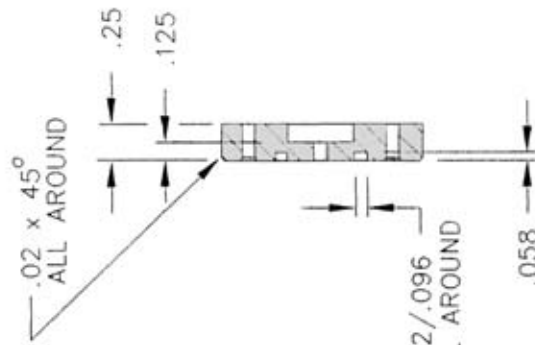







## FLANGE COVER

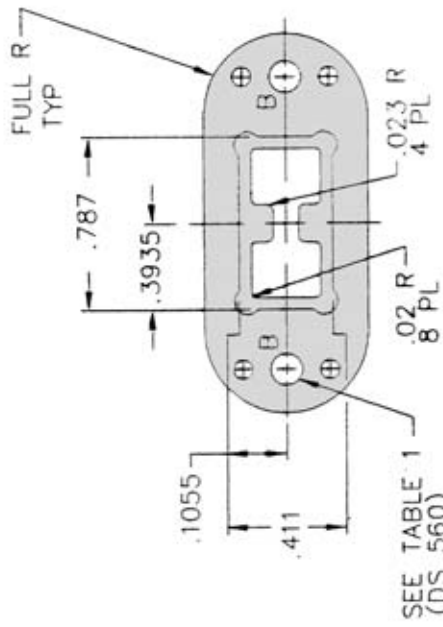
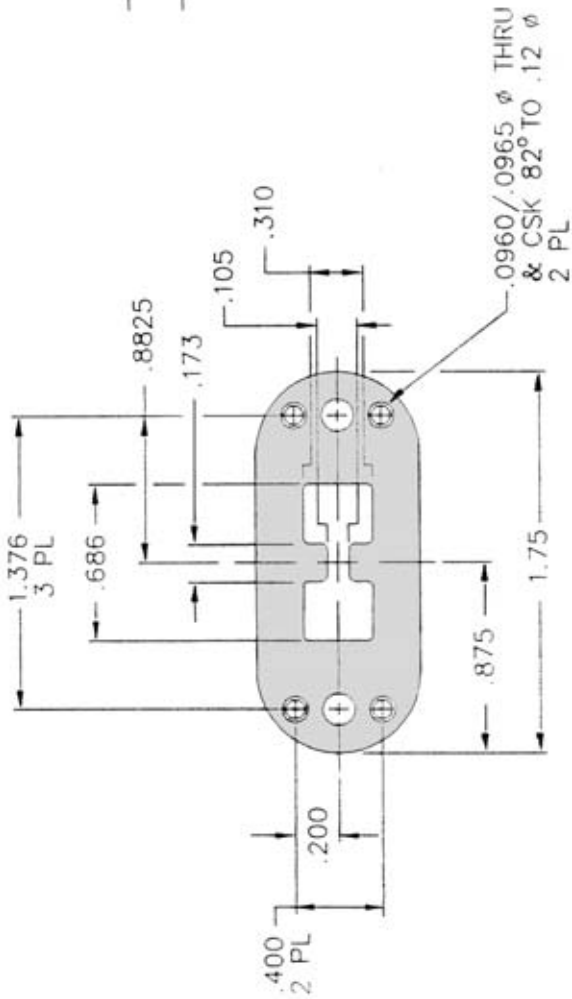
WRD 700 (DES-1-C)



 **Continental Microwave & Tool Company, Inc.**  
A Chelton Microwave Company  
11 Continental Drive, Bower, WI 53003-3009  
Tel: (608) 775-9200 • e-mail: [cmtr@cmtrco.com](mailto:cmtr@cmtrco.com) • fax: (608) 775-9291 • URL: [www.cmtrco.com](http://www.cmtrco.com)

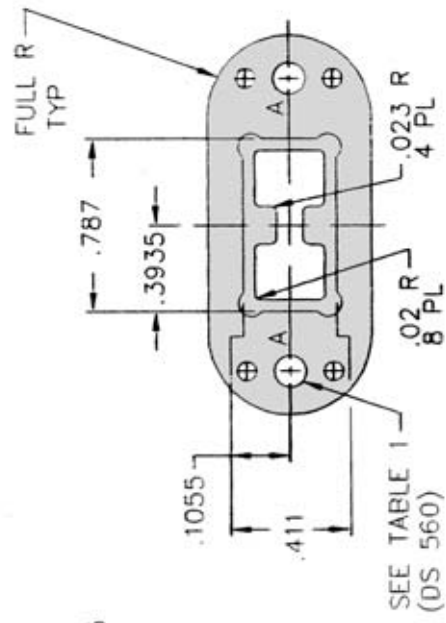
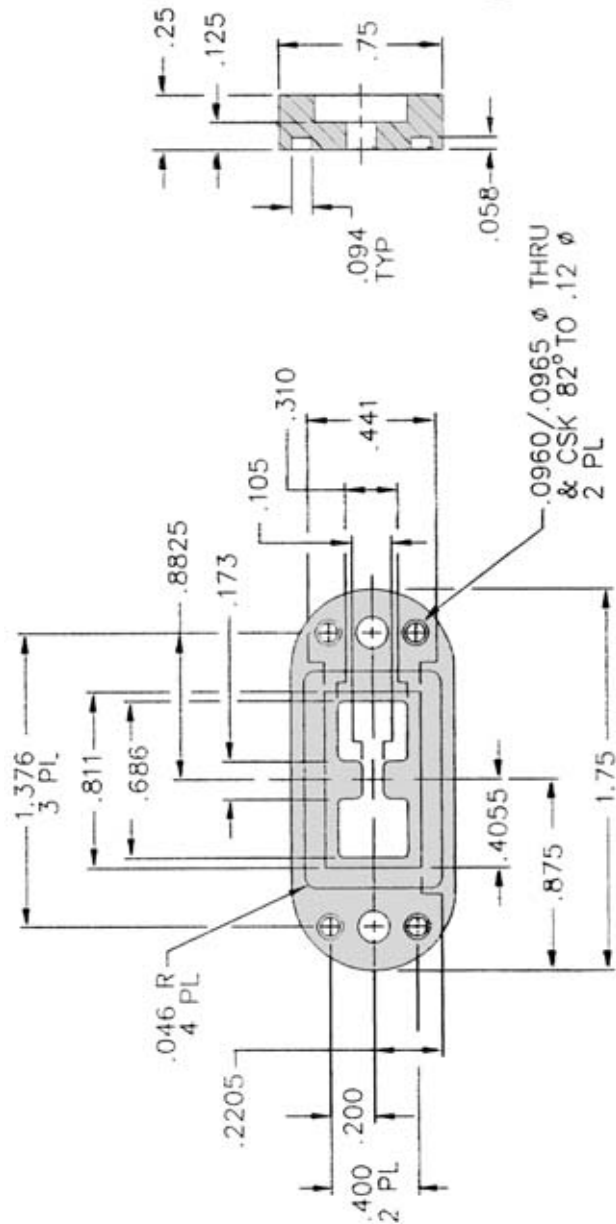
## FLANGE GASKET

WRD 700 (DES-1-G)



## FLANGE, COVER

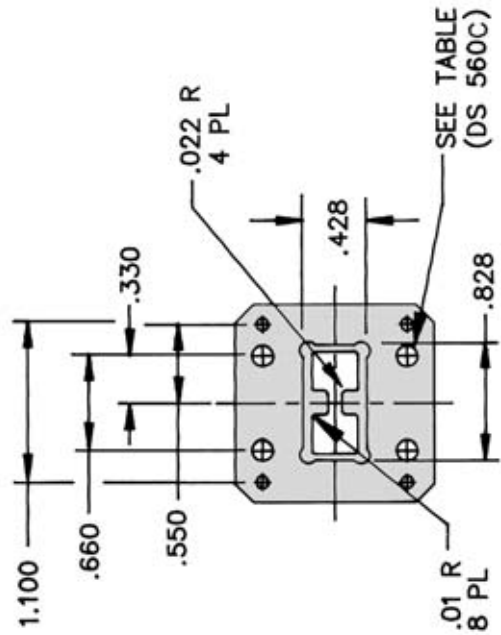
WRD 700 SLIM-LINE (DES-2-C)



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 A Chelton Microwave Company  
11 Continental Drive, Elmer, NJ 08843-6569  
 Tel: (609) 775-9300 • e-mail: rtw@continentalco.com • fax: (609) 775-9391 • URL: www.continentalco.com

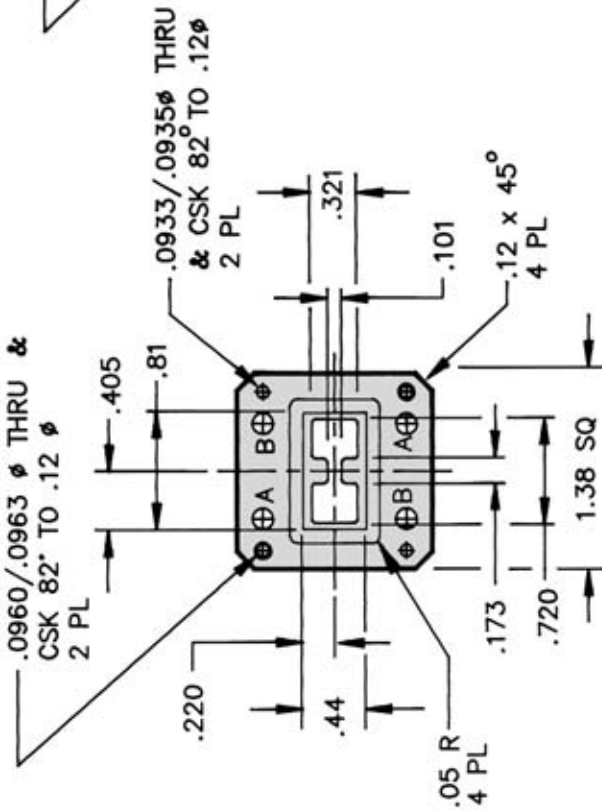
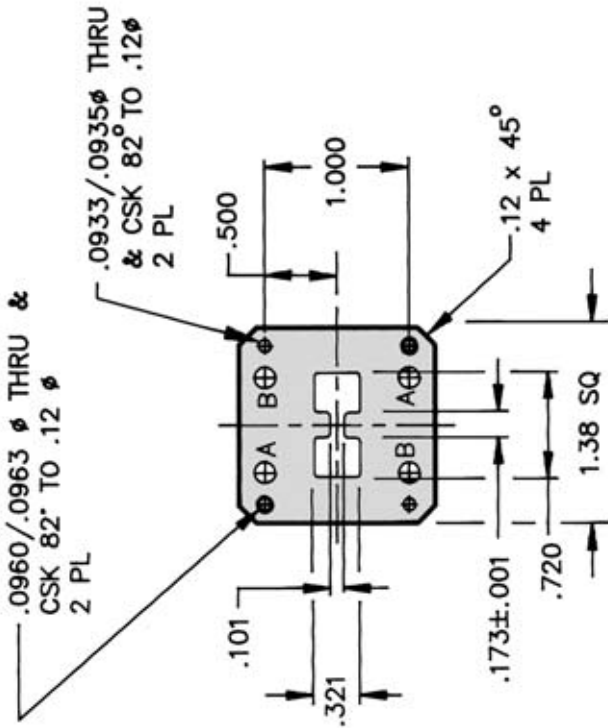
## FLANGE, GASKET

WRD 700 SLIM-LINE (DES-3-G)



## FLANGE COVER

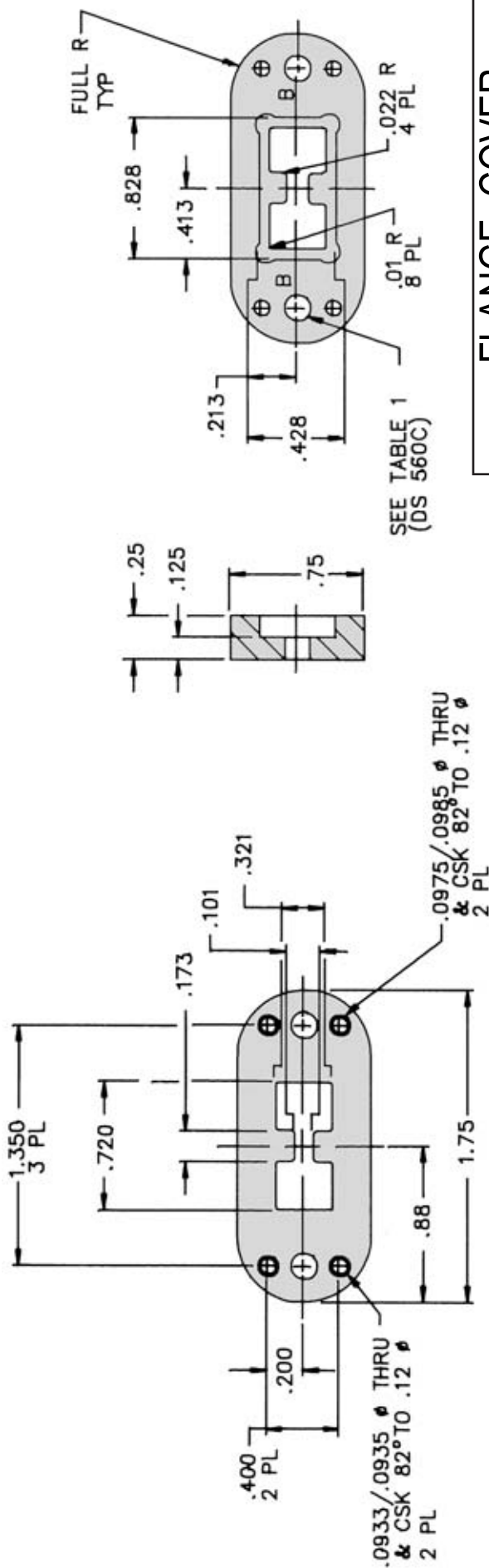
WRD 650 (DES-1-C)



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 A Chelton Microwave Company  
 1 Continental Drive, Elmer, NJ 08533-6509  
 Tel: (609) 775-8200, e: cmt@continentalmicrowave.com, fax: (609) 775-8291, URL: www.continental.com

## FLANGE GASKET

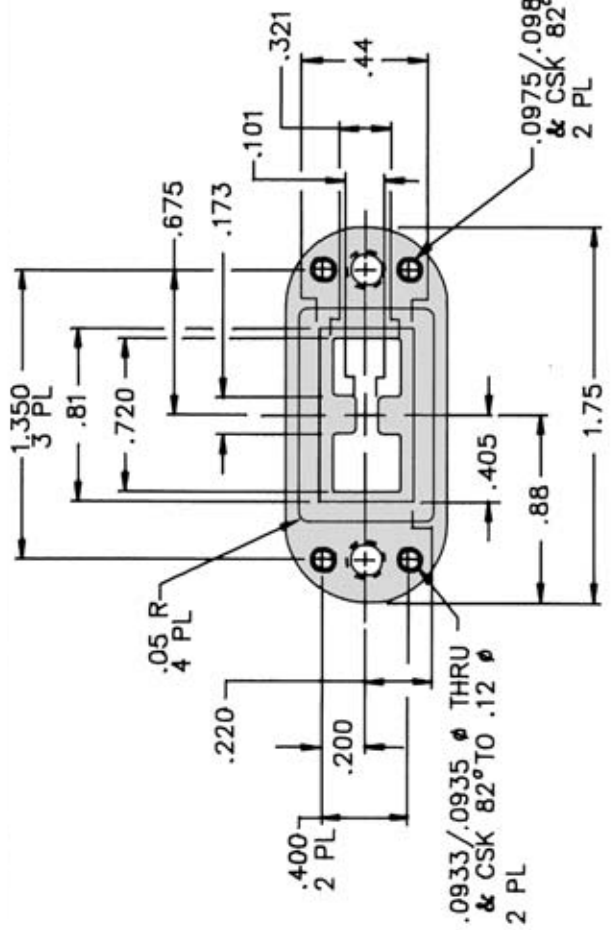
WRD 650 (DES-1-G)



SEE TABLE 1  
(DS 560C)

### FLANGE COVER

WRD 650 SLIM-LINE (DES-2-C)

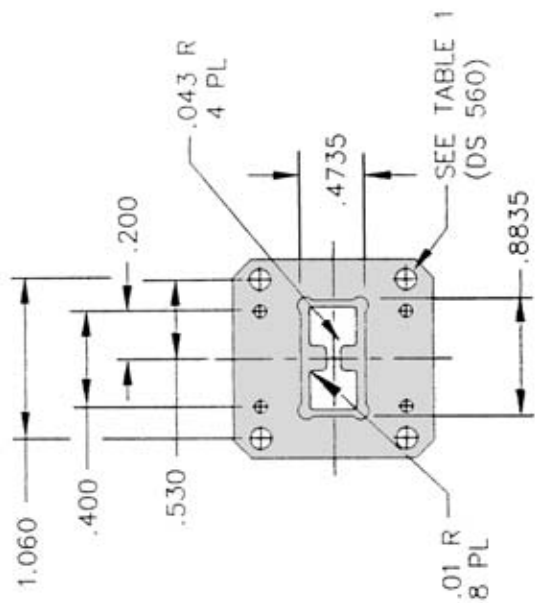


SEE TABLE 1  
(DS 560C)

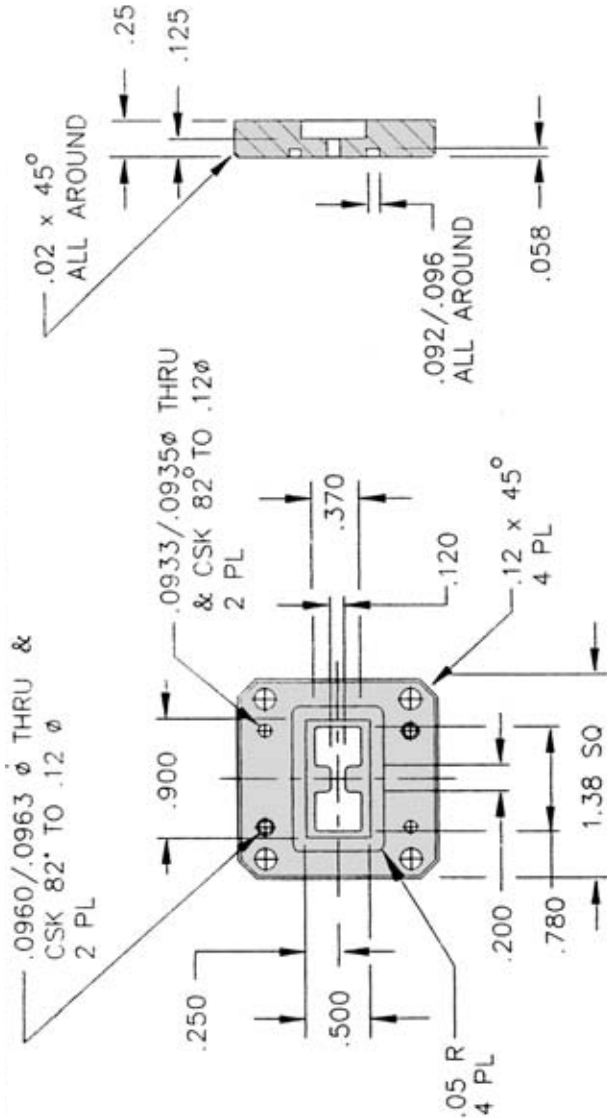
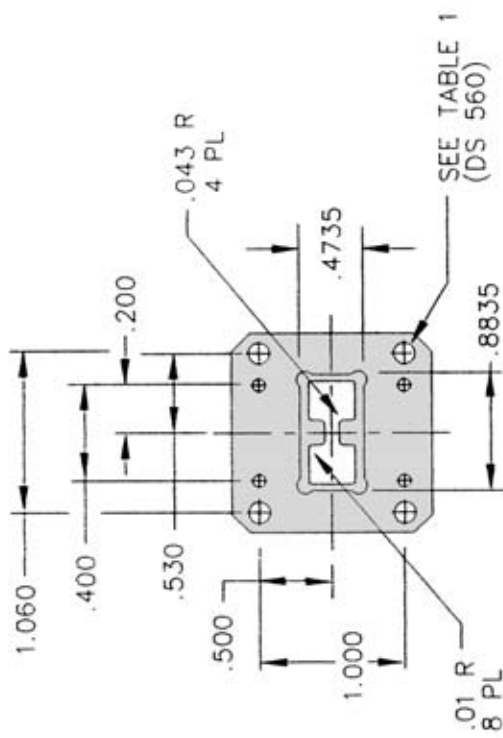
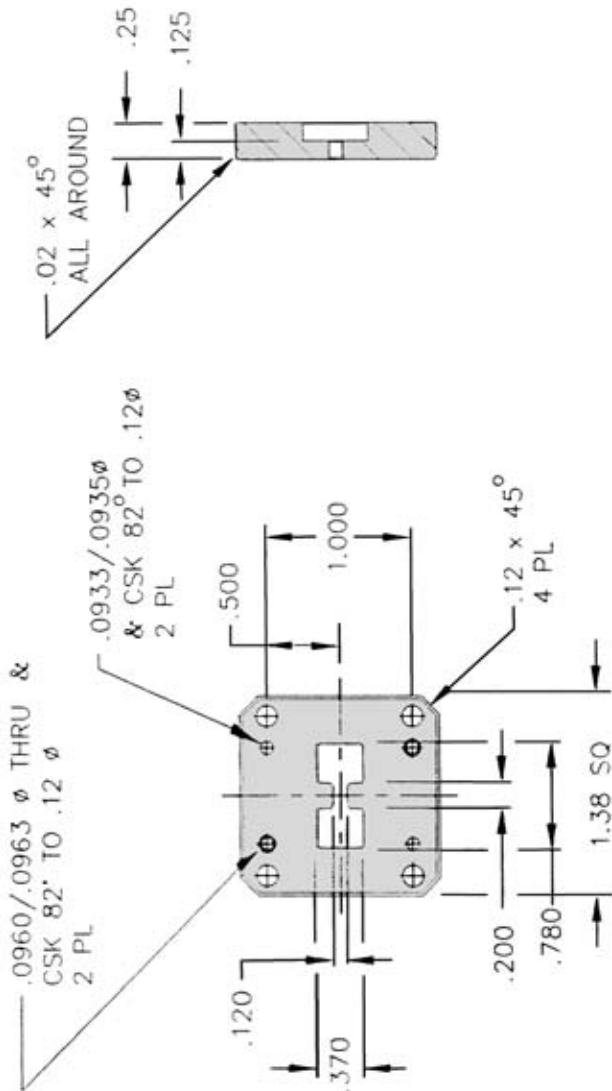
### FLANGE GASKET

WRD 650 SLIM-LINE (DES-3-G)

Continental Microwave & Tool Company, Inc.  
A Chelton Microwave Company  
1 Continental Drive, Bower, WI 53003-3566  
Tel: (608) 775-9300 • e-mail: rtw@continental.com • fax: (608) 775-9321 • URL: www.contmic.com

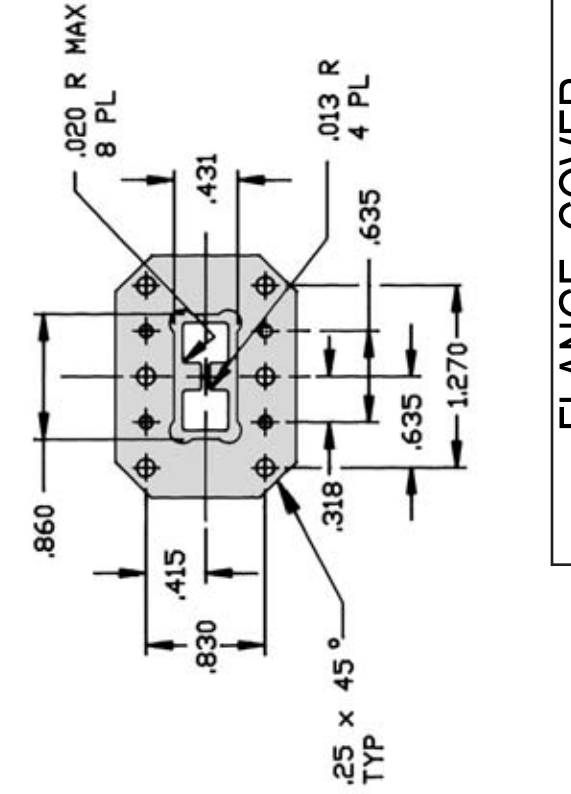


**FLANGE COVER**  
WRD 580 (DES-1-C)

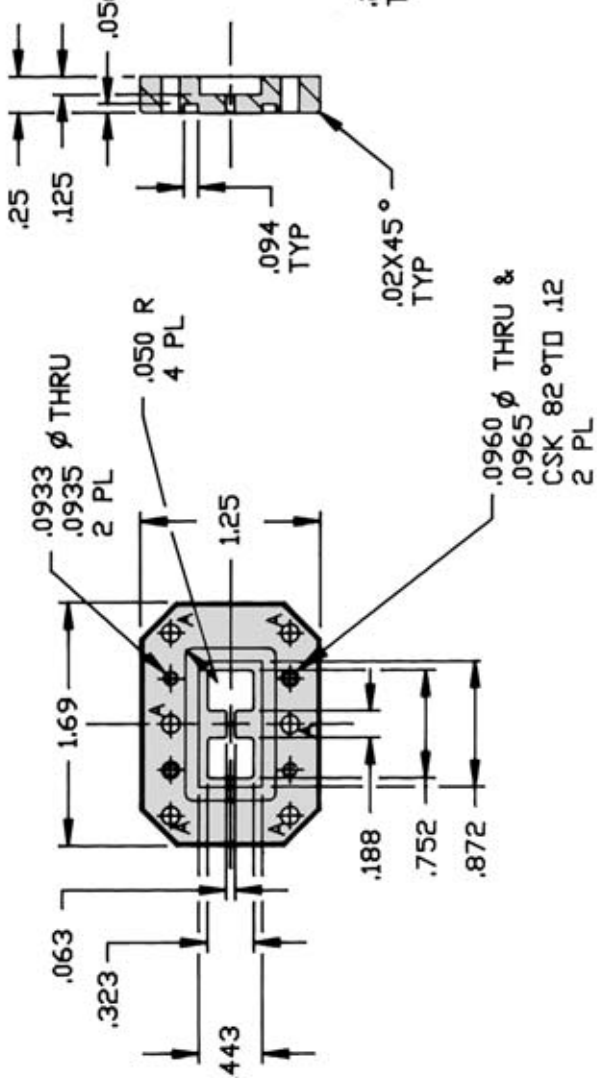
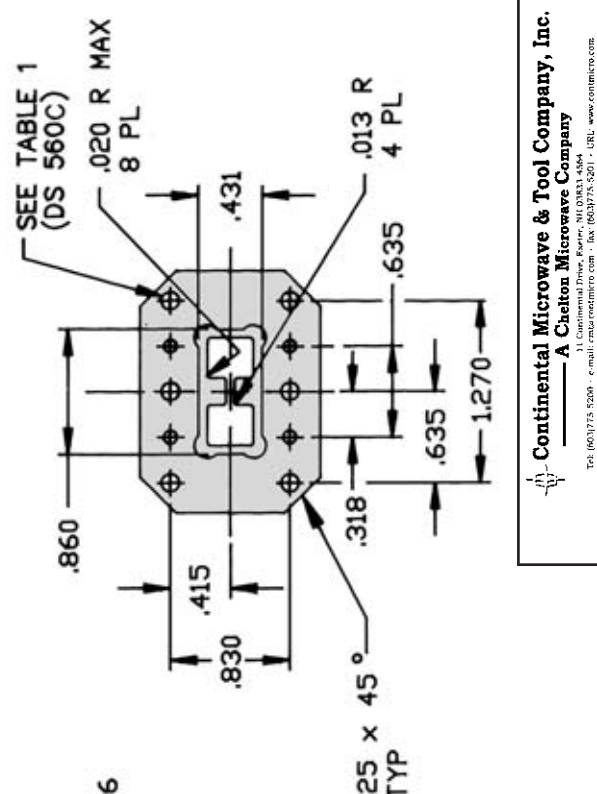
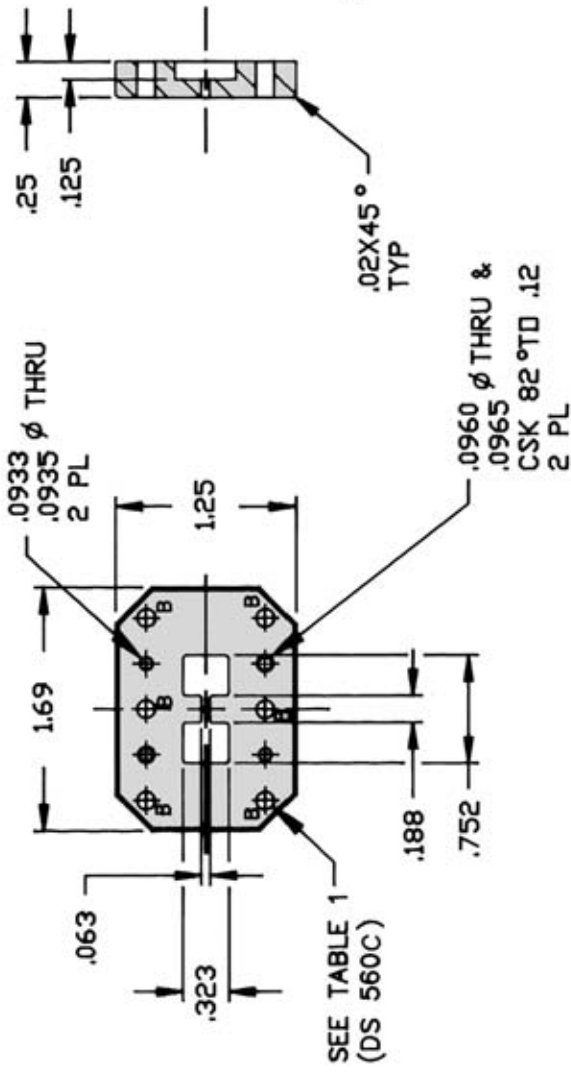


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A Chelton Microwave Company  
11 Continental Drive, Brierley, MI 48343-6067  
Tel: (601) 775-9200, e: cca@continentalmco.com, fax: (601) 775-9291, URL: www.continentalmco.com

**FLANGE GASKET**  
WRD 580 (DES-1-G)

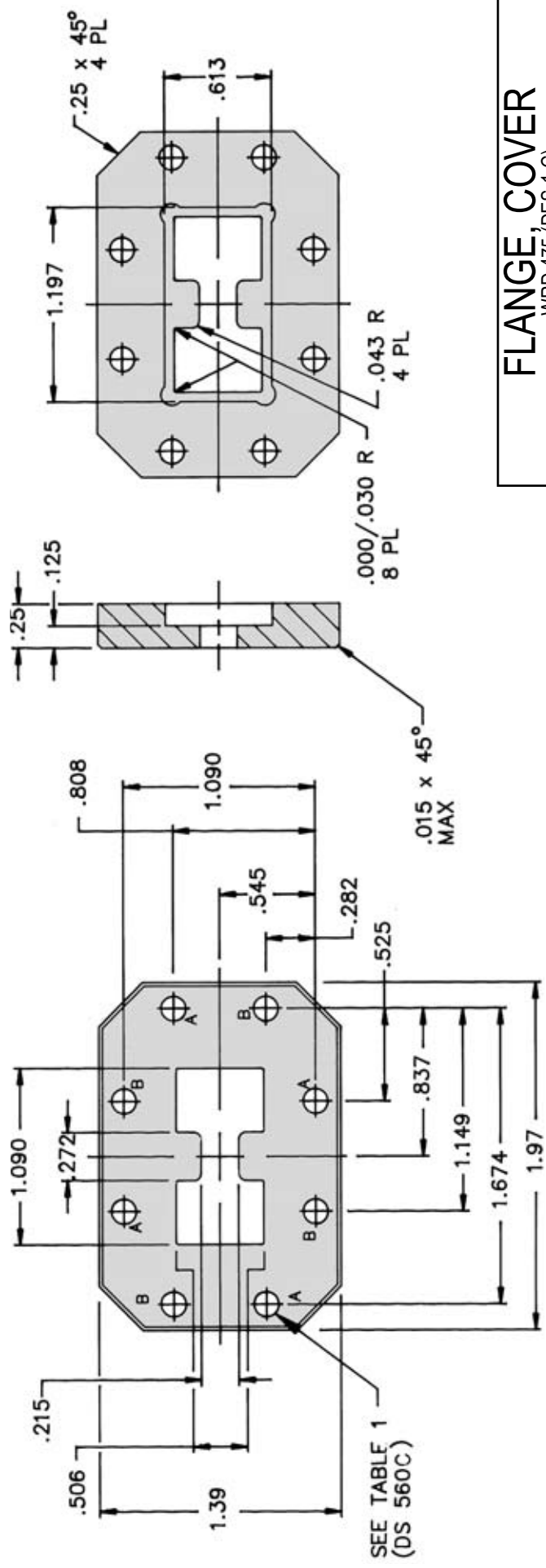


### FLANGE COVER WRD 500 (DES-2-C)

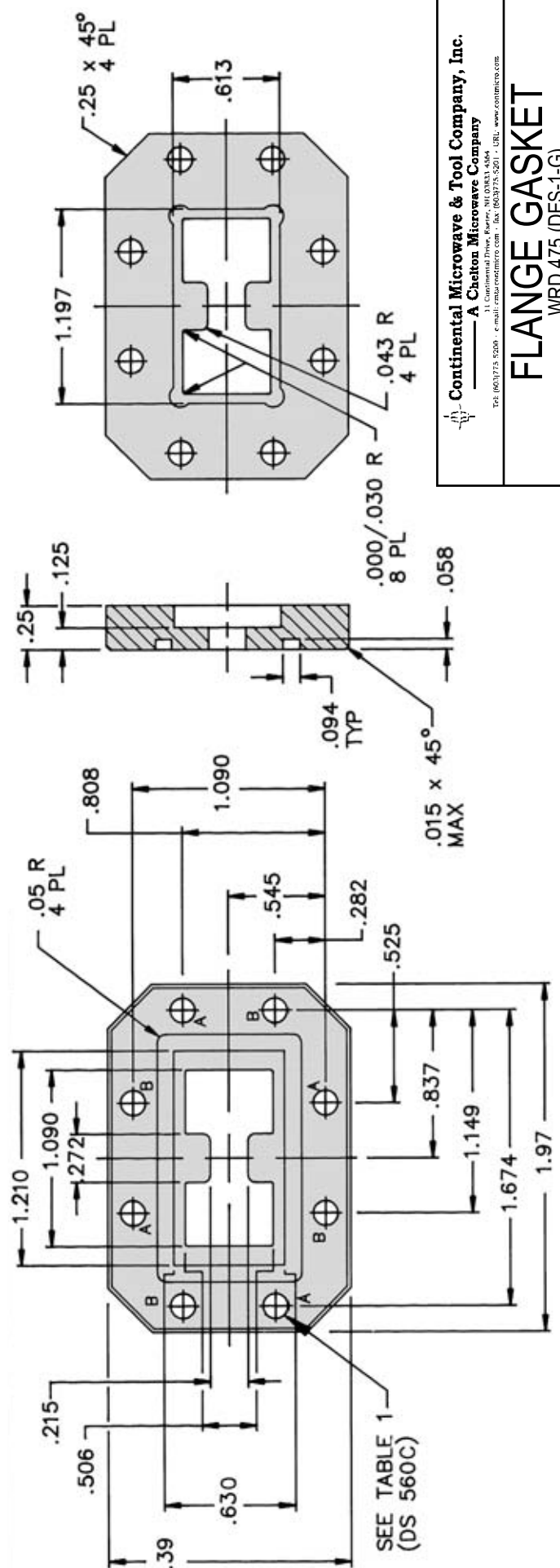


Continental Microwave & Tool Company, Inc.  
A Chelton Microwave Company  
1 Continental Drive, Dover, NH 03843-0500  
Tel: (603) 753-9300, e-mail: rps@continentalco.com, fax: (603) 753-9301, URL: www.continentalco.com

### FLANGE GASKET WRD 500 (DES-3-G)

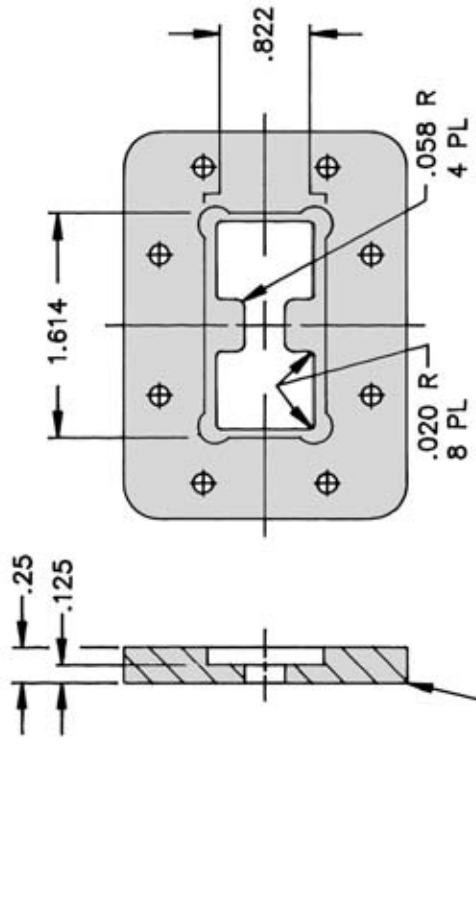
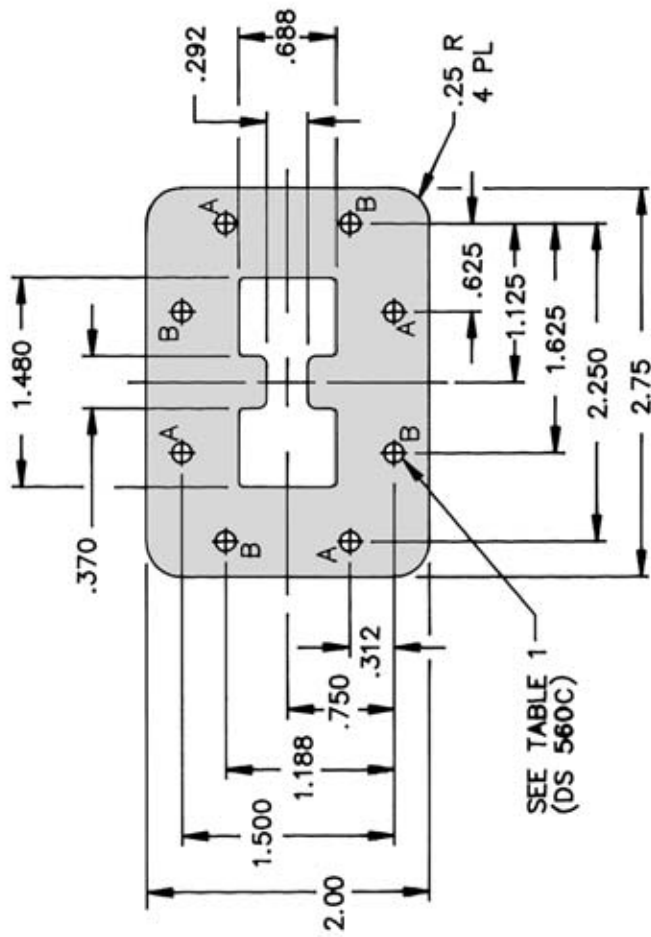


**FLANGE COVER**  
WRD 475 (DES-1-C)



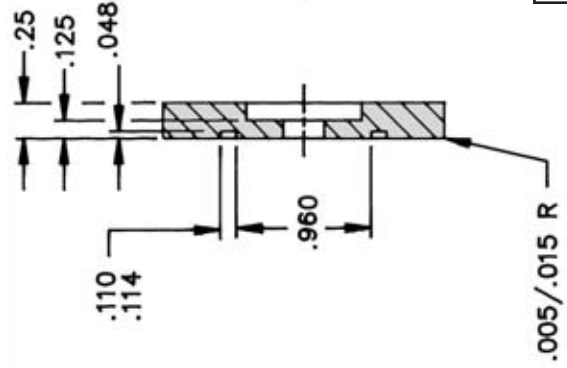
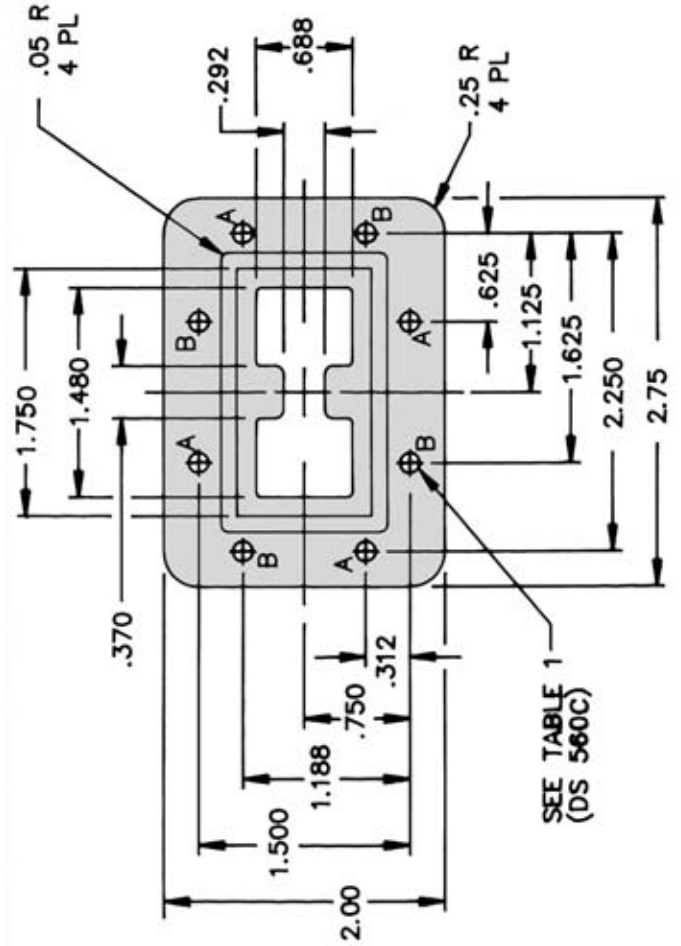
**FLANGE GASKET**  
WRD 475 (DES-1-G)

Continental Microwave & Tool Company, Inc.  
A Chelton Microwave Company  
11 Continental Drive, Pawcatuck, CT 06353-3506  
Tel: (800) 775-9200, e: cmail@continentalmicrowave.com, fax: (860) 775-9201, URL: www.continentalmicrowave.com



## FLANGE COVER

WRD 350 (DES-1-C)



SEE TABLE 1  
(DS 560C)

SEE TABLE 1  
(DS 560C)

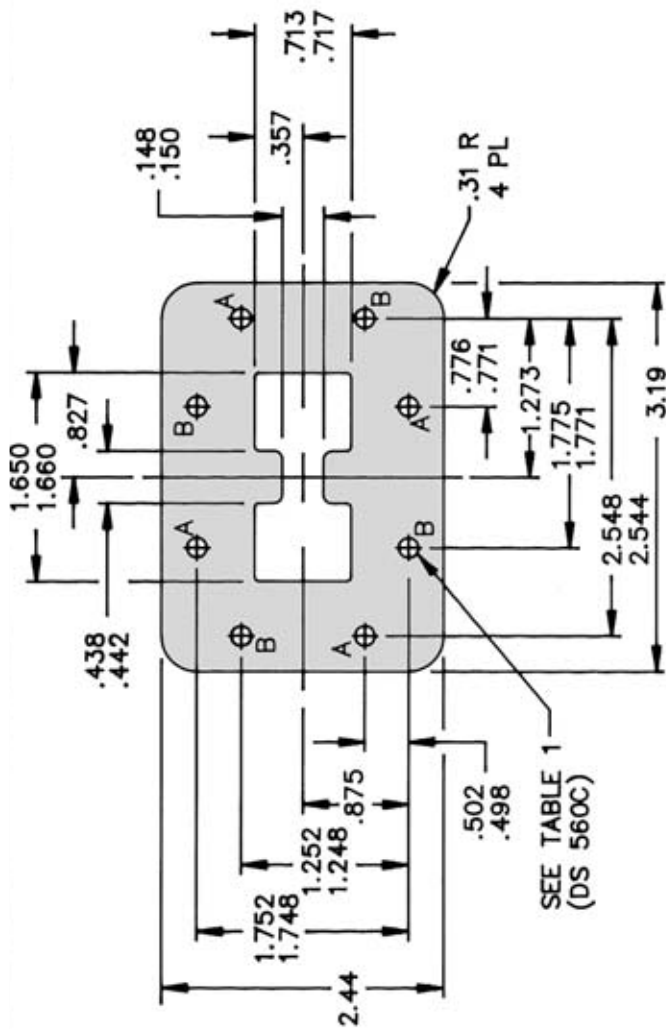


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A Chelton Microwave Company  
11 Continental Drive, Bldg. #103A33, Dover, NH 03824  
Tel: (603) 753-9300, e-mail: rps@continental.com, fax: (603) 753-9391, URL: www.contmic.com

## FLANGE GASKET

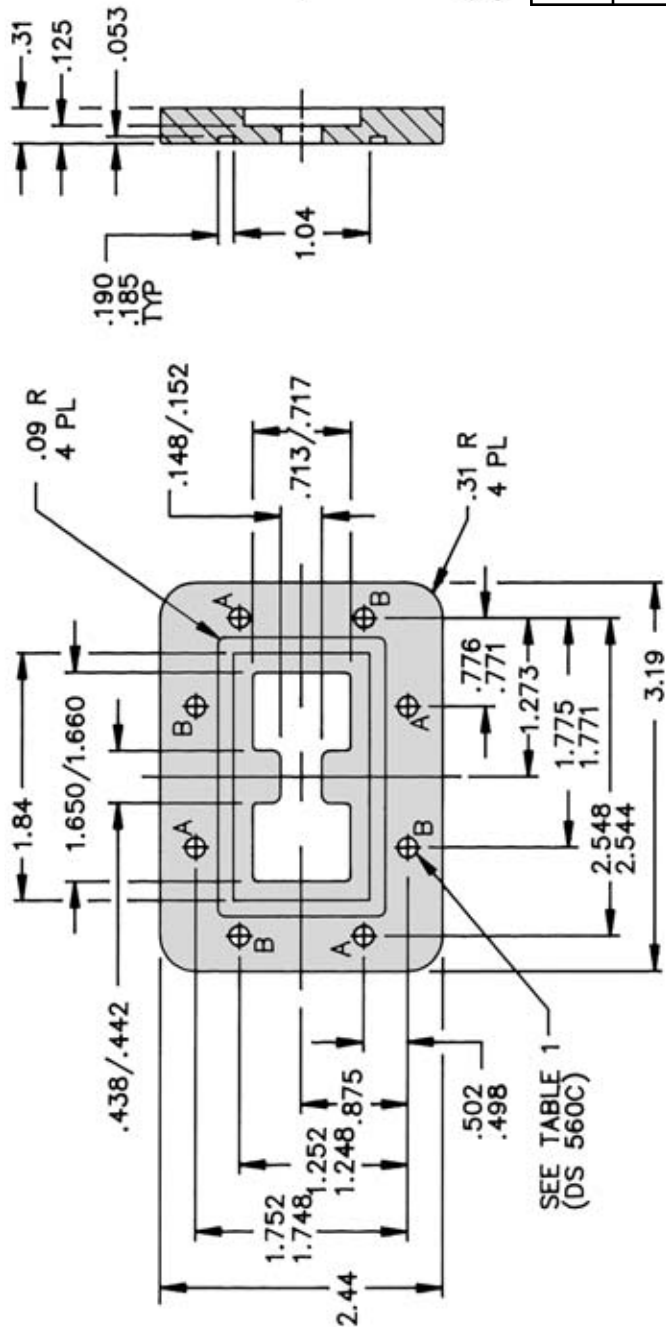
WRD 350 (DES-1-G)





### FLANGE COVER

WRD 250 (DES-1-C)



### FLANGE GASKET

WRD 250 (DES-1-G)

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