G-T Ring

G-T® RING

Sealing Solutions for Demanding Environments

HIGH-PRESSURE, HIGH-TEMPERATURE SEALS

The unique G-T® Ring provides a compact, double-acting seal for use in new designs or existing applications where O-rings are failing. The G-T Ring can be retrofitted into standard grooves designed for O-rings with one, two or no backups. This proven seal combines a tough, resilient, T-shaped ring with precisely dimensioned, pressure-actuated, anti-extrusion rings for use with pressure ratings up to 3000 bar (43,500 psi). For higher pressures consult Greene, Tweed.

FEATURES

- Easy installation
- Excellent resistence to extrusion
- Extended service life
- Unique configuration eliminates seal roll and spiral failure
- Low pressure sealing

The G-T Ring is a static or dynamic seal in “rod” or “piston” configurations for demanding oilfield applications, e.g., cylinders, jacks, intensifiers, tensioners, BOPs, logging equipment, jars, shock subs, bumper subs, pumps, valves and well head equipment.

Contact Us

Greene, Tweed & Co.
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www.gtweed.com

03/05-GT DS-US-OF-027

G-T® RING
Case History

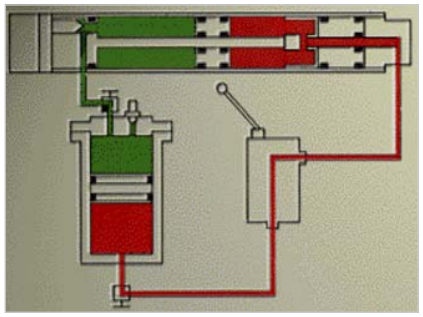
PDS (POSITIVE DISPLACEMENT SAMPLING)

For the North Sea and International Well Test Service Industry, Aberdeen-based Leutert (North Sea) Ltd. has developed a mercury-free PDS. The system is designed to retrieve representative subsurface or surface oil samples without risk to the environment or personnel.

Developed over three years, the company's PDS system has now been used in over 600 North Sea and international sampling operation tool runs with a very high success rate in retrieving representative well fluid samples.

Manufactured from high-tensile, corrosion-resistant materials, the PDS sampler is particularly suited to operations where sour gas may be present.

Greene, Tweed seals were chosen because of their ability to withstand pressures up to 15,000 psi (1035 bar) at a working temperature of 350ºF (177ºC) while in contact with H_2S or other corrosive elements.



Positive Displacement Sampling

SRS (SINGLE PHASE RESERVOIR SAMPLER)

Greene, Tweed is supplying G-T® Rings (with Arlon® thermoplastic) and extrusion rings for inclusion on a SRS.

This advanced and unique sampling system for all wireline applications allows samples to be retrieved and maintained in virgin condition.

Greene, Tweed seals were chosen because of their ability to withstand pressures up to 15,000 psi (1,035 bar) at a working temperature of 350ºF (177ºC), while in contact with H_2S.

Oilphase's sampling system allows uncontaminated reservoir sampling without sample flashing. The sample is retrieved at surface in single-phase state and does not require lengthy recombination before transfer.

Single Phase Reservoir Sampler

Contact Us

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03/05-GT DS-US-OF-032

Greene Tweed
INDUSTRIAL GROUP

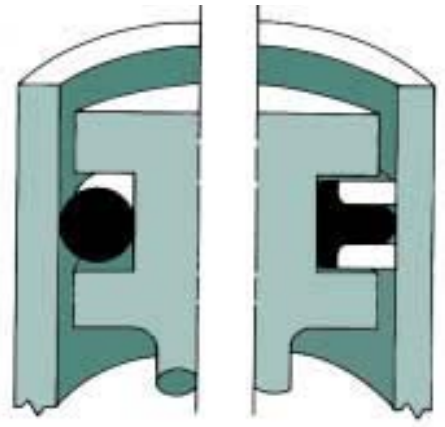
INDUSTRIAL GT® RING

6,000 Series · 8,000 Series Technical Datasheet

INDUSTRIAL GT® RING

6,000 Series · 8,000 Series

STANDARD CLEARANCE LIMITS	
Bore Size Range	Max. Dia. Clearance
.250" to .500"	.004"
.501" to 1.750"	.005"
1.751" to 4.875"	.007"
4.876" to 9.000"	.009"
9.001" - up	.010"



Piston Seals

For sizes not shown, please contact your G-T Ring Distributor or Greene, Tweed Engineering.

TABLE 1 8,000 SERIES DIMENSIONAL INFORMATION

G-T Ring Part No. Prefix	Nominal Seal Size OD	ID	Cross-Section	Metal Dimensions Bore Diam. +.001" -.001"	Groove Diam. +.002" -.000"	Groove Length +.005" -.000"
8051	3/8	3/16	3/32	.375	.190	.150
8052	7/16	1/4	3/32	.4375	.2525	.150
8053	1/2	5/16	3/32	.500	.315	.150
8054	9/16	5/16	1/8	.5625	.3175	.185
8055	5/8	3/8	1/8	.625	.380	.185
8056	11/16	7/16	1/8	.6875	.4425	.185
8057	3/4	1/2	1/8	.750	.505	.185
8058	13/16	9/16	1/8	.8125	.5675	.185
8059	7/8	5/8	1/8	.875	.630	.185
8060	15/16	11/16	1/8	.9375	.6925	.185
8061	1	3/4	1/8	1.001	.756	.185
8062	1 1/16	13/16	1/8	1.0635	.8185	.185
8063	1 1/8	7/8	1/8	1.126	.881	.185
8064	1 3/16	15/16	1/8	1.1885	.9435	.185
8065	1 1/4	1	1/8	1.251	1.006	.185
8066	1 5/16	1 1/16	1/8	1.3135	1.0685	.185
8067	1 3/8	1 1/8	1/8	1.376	1.131	.185
8068	1 7/16	1 3/16	1/8	1.4385	1.1935	.185
8069	1 1/2	1 1/4	1/8	1.501	1.256	.185
8070	1 9/16	1 5/16	1/8	1.563	1.318	.185
8071	1 5/8	1 3/8	1/8	1.626	1.381	.185
8072	1 11/16	1 7/16	1/8	1.688	1.442	.185
8073	1 3/4	1 1/2	1/8	1.751	1.506	.185
8074	1 7/8	1 1/2	3/16	1.876	1.502	.280
8204	1 15/16	1 9/16	3/16	1.939	1.564	.280
8075	2	1 5/8	3/16	2.001	1.627	.280
8076	2 1/16	1 11/16	3/16	2.063	1.690	.280
8077	2 1/8	1 3/4	3/16	2.126	1.752	.280
8078	2 1/4	1 7/8	3/16	2.251	1.877	.280
8079	2 3/8	2	3/16	2.376	2.002	.280
8080	2 1/2	2 1/8	3/16	2.501	2.127	.280
8082	2 5/8	2 1/4	3/16	2.626	2.252	.280
				+.002" -.002"	+.003" -.001"	+.005" -.000"
8083	2 3/4	2 3/8	3/16	2.751	2.377	.280
8084	2 7/8	2 1/2	3/16	2.876	2.502	.280
8085	3	2 5/8	3/16	3.001	2.627	.280
8086	3 1/8	2 3/4	3/16	3.126	2.752	.280
8087	3 1/4	2 7/8	3/16	3.251	2.877	.280
8088	3 3/8	3	3/16	3.377	3.003	.280
8089	3 1/2	3 1/8	3/16	3.502	3.128	.280

TABLE 1 8,000 SERIES DIMENSIONAL INFORMATION (CONTINUED)

G-T Ring Part No. Prefix	Nominal Seal Size OD	ID	Cross-Section	Metal Dimensions Bore Diam. +.002" -.002"	Groove Diam. +.003" -.001"	Groove Length +.005" -.000"
8090	3 5/8	3 1/4	3/16	3.627	3.253	.280
8091	3 3/4	3 3/8	3/16	3.752	3.378	.280
8092	3 7/8	3 1/2	3/16	3.877	3.503	.280
8093	4	3 5/8	3/16	4.002	3.628	.280
8094	4 1/8	3 3/4	3/16	4.127	3.753	.280
8095	4 1/4	3 7/8	3/16	4.252	3.878	.280
8096	4 3/8	4	3/16	4.377	4.003	.280
8097	4 1/2	4 1/8	3/16	4.502	4.128	.280
8098	4 5/8	4 1/4	3/16	4.627	4.253	.280
8099	4 3/4	4 3/8	3/16	4.752	4.378	.280
8100	4 7/8	4 1/2	3/16	4.877	4.503	.280
8101	5	4 5/8	3/16	5.003	4.629	.280
8102	5 1/8	4 5/8	1/4	5.128	4.649	.366
8103	5 1/4	4 3/4	1/4	5.253	4.774	.366
8104	5 3/8	4 7/8	1/4	5.378	4.899	.366
8105	5 1/2	5	1/4	5.503	5.024	.366
8106	5 5/8	5 1/8	1/4	5.628	5.149	.366
8107	5 3/4	5 1/4	1/4	5.753	5.274	.366
8108	5 7/8	5 3/8	1/4	5.878	5.399	.366
8109	6	5 1/2	1/4	6.003	5.524	.366
8110	6 1/8	5 5/8	1/4	6.128	5.649	.366
8111	6 1/4	5 3/4	1/4	6.253	5.774	.366
				+.003" -.003"	+.004" -.002"	+.005" -.000"
8271	6 3/8	5 7/8	1/4	6.378	5.899	.366
8113	6 1/2	6	1/4	6.503	6.024	.366
8114	6 3/4	6 1/4	1/4	6.753	6.274	.366
8115	7	6 1/2	1/4	7.003	6.524	.366
8161	7 1/8	6 5/8	1/4	7.128	6.649	.366
8116	7 1/4	6 3/4	1/4	7.253	6.774	.366
8117	7 1/2	7	1/4	7.503	7.024	.366
8118	7 3/4	7 1/4	1/4	7.753	7.274	.366
8119	8	7 1/2	1/4	8.003	7.524	.366
8120	8 1/4	7 3/4	1/4	8.253	7.774	.366
8121	8 1/2	8	1/4	8.503	8.024	.366
8167	8 5/8	8 1/8	1/4	8.628	8.149	.366
8122	9	8 1/2	1/4	9.003	8.524	.366
8164	9 1/4	8 3/4	1/4	9.253	8.774	.366
8123	9 1/2	9	1/4	9.503	9.024	.366
8124	10	9 1/2	1/4	10.003	9.524	.366
8130	10 1/8	9 5/8	1/4	10.128	9.646	.366
8125	10 1/2	10	1/4	10.503	10.024	.366
8126	11	10 1/2	1/4	11.003	10.524	.366
8261	11 3/8	10 7/8	1/4	11.378	10.899	.366
8127	11 1/2	11	1/4	11.503	11.021	.366

Style 6000 and 8000 GT Rings have radial cross sections smaller than comparable size AS-568A O-rings. They should be used when lower friction is required.

Style 10,000 and 12,000 GT Rings have radial cross section dimensions equal to AS-568A O-rings, and are available in three axial length glands. THESE STYLES SHOULD BE USED IN ALL NEW DESIGNS.

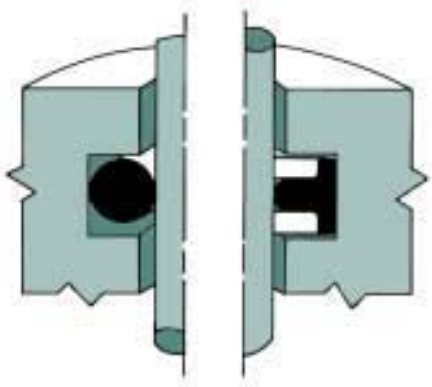
G-T Rings are also available for glands designed for an O-ring with one backup (Interbase), and for O-rings with two backups (Widebase). See Style #10/Style #12 G-T Ring Catalog. For glands not covered in either catalog please consult Greene, Tweed's product engineering department.

For pressures above 3000 psi or temperatures above 275F, contact GTC Engineering Department for recommendations.

TABLE 1 8,000 SERIES DIMENSIONAL INFORMATION (CONTINUED)

G-T Ring Part No. Prefix	Nominal Seal Size OD	ID	Cross-Section	Metal Dimensions Bore Diam. +.003" -.003"	Groove Diam. +.004" -.002"	Groove Length +.005" -.000"
8128	12	11 1/2	1/4	12.003	11.524	.366
8266	12 1/4	11 3/4	1/4	12.253	11.774	.366
8265	12 1/2	12	1/4	12.503	12.024	.366
8278	12 3/4	12 1/4	1/4	12.753	12.274	.366
8211	13	12 1/2	1/4	13.003	12.524	.366
8243	14	13 1/2	1/4	14.003	13.524	.366
8142	14 1/4	13 3/4	1/4	14.253	13.774	.366
8129	15	14 1/2	1/4	15.003	14.524	.366
8287	15 1/2	15	1/4	15.503	15.024	.366
8224	15 3/4	15 1/4	1/4	15.753	15.274	.366
8144	16	15 1/2	1/4	16.003	15.524	.366
8227	19	18 1/2	1/4	19.003	18.524	.366
8268	20	19 1/2	1/4	20.003	19.524	.366

STANDARD CLEARANCE LIMITS Bore Size Range	Max. Dia. Clearance
.123" to .375"	.004"
.376" to 1.500"	.005"
1.501" to 4.500"	.007"
4.501" to 8.500"	.009"
8.501" - up	.010"



Rod Seals
For sizes not shown, please contact your G-T Ring Distributor or Greene, Tweed Engineering.

TABLE 2 6,000 SERIES DIMENSIONAL INFORMATION

G-T Ring Part No. Prefix	Nominal Seal Size ID	OD	Cross-Section	Metal Dimensions Bore Diam. +.001" -.001"	Groove Diam. +.002" -.000"	Groove Length +.005" -.000"
6051	3/16	3/8	3/32	.1855	.3705	.150
6052	1/4	7/16	3/32	.248	.433	.150
6053	5/16	1/2	3/32	.3105	.4955	.150
6054	3/8	5/8	1/8	.373	.618	.185
6055	7/16	11/16	1/8	.4355	.6805	.185
6056	1/2	3/4	1/8	.498	.743	.185
6057	9/16	13/16	1/8	.5605	.8055	.185
6058	5/8	7/8	1/8	.623	.868	.185
6059	11/16	15/16	1/8	.6855	.9305	.185
6060	3/4	1	1/8	.747	.992	.185
6061	13/16	1 1/16	1/8	.8095	1.0545	.185
6062	7/8	1 1/8	1/8	.872	1.117	.185
6063	15/16	1 3/16	1/8	.9345	1.1795	.185
6064	1	1 1/4	1/8	.997	1.242	.185
6065	1 1/16	1 5/16	1/8	1.059	1.304	.185
6066	1 1/8	1 3/8	1/8	1.122	1.367	.185
6067	1 3/16	1 7/16	1/8	1.1845	1.4295	.185
6068	1 1/4	1 1/2	1/8	1.247	1.492	.185
6069	1 5/16	1 9/16	1/8	1.309	1.554	.185
6070	1 3/8	1 5/8	1/8	1.372	1.617	.185
6071	1 7/16	1 11/16	1/8	1.4345	1.6795	.185
6072	1 1/2	1 3/4	1/8	1.497	1.742	.185
6073	1 1/2	1 7/8	3/16	1.497	1.871	.280
6168	1 9/16	1 15/16	3/16	1.560	1.934	.280
6074	1 5/8	2	3/16	1.622	1.996	.280
6075	1 3/4	2 1/8	3/16	1.747	2.121	.280
6076	1 7/8	2 1/4	3/16	1.872	2.246	.280

TABLE 2 6,000 SERIES DIMENSIONAL INFORMATION (CONTINUED)

G-T Ring Part No. Prefix	Nominal Seal Size			Metal Dimensions		
	ID	OD	Cross-Section	Bore Diam. +.001" -.001"	Groove Diam. +.002" -.002"	Groove Length +.005" -.000"
6077	2	2 3/8	3/16	1.997	2.371	.280
6078	2 1/8	2 1/2	3/16	2.122	2.496	.280
6079	2 1/4	2 5/8	3/16	2.247	2.613	.280
				+.002" -.002"	+.001" -.003"	+.005" -.000"
6080	2 3/8	2 3/4	3/16	2.372	2.746	.280
6081	2 1/2	2 7/8	3/16	2.497	2.871	.280
6082	2 5/8	3	3/16	2.622	2.996	.280
6083	2 3/4	3 1/8	3/16	2.747	3.121	.280
6084	2 7/8	3 1/4	3/16	2.872	3.246	.280
6085	3	3 3/8	3/16	2.996	3.370	.280
6086	3 1/8	3 1/2	3/16	3.121	3.495	.280
6087	3 1/4	3 5/8	3/16	3.246	3.620	.280
6088	3 3/8	3 3/4	3/16	3.371	3.745	.280
6089	3 1/2	3 7/8	3/16	3.496	3.870	.280
6090	3 5/8	4	3/16	3.621	3.995	.280
6091	3 3/4	4 1/8	3/16	3.746	4.120	.280
6092	3 7/8	4 1/4	3/16	3.871	4.245	.280
6093	4	4 3/8	3/16	3.996	4.370	.280
6094	4 1/8	4 1/2	3/16	4.121	4.495	.280
6095	4 1/4	4 5/8	3/16	4.246	4.620	.280
6096	4 3/8	4 3/4	3/16	4.371	4.745	.280
6097	4 1/2	4 7/8	3/16	4.496	4.870	.280
6193	4 5/8	5	3/16	4.621	4.995	.280
6225	4 3/4	5 1/8	3/16	4.748	5.122	.280
6100	4 7/8	5 3/8	1/4	4.872	5.350	.366
6101	5	5 1/2	1/4	4.996	5.475	.366
6103	5 1/4	5 3/4	1/4	5.246	5.725	.366
6105	5 1/2	6	1/4	5.496	5.975	.366
6106	5 5/8	6 1/8	1/4	5.621	6.100	.366
				+.003" -.003"	+.002" -.004"	+.005" -.000"
6200	5 7/8	6 3/8	1/4	5.872	6.350	.366
6109	6	6 1/2	1/4	5.996	6.475	.366
6110	6 1/4	6 3/4	1/4	6.246	6.725	.366
6111	6 1/2	7	1/4	6.496	6.975	.366
6112	6 3/4	7 1/4	1/4	6.746	7.225	.366
6113	7	7 1/2	1/4	6.996	7.475	.366
6114	7 1/4	7 3/4	1/4	7.246	7.725	.366
6146	7 1/2	8	1/4	7.500	7.984	.366
6116	7 3/4	8 1/4	1/4	7.746	8.225	.366
6117	8	8 1/2	1/4	7.996	8.475	.366
6118	8 1/2	9	1/4	8.500	8.984	.366
6119	9	9 1/2	1/4	8.996	9.475	.366
6120	9 1/2	10	1/4	9.496	9.975	.366
6121	10	10 1/2	1/4	9.996	10.475	.366
6216	10 5/16	10 13/16	1/4	10.312	10.788	.366
6241	10 5/16	10 13/16	1/4	10.312	10.787	.366
6185	10 7/16	10 15/16	1/4	10.437	10.921	.366

PART NUMBER SYSTEM

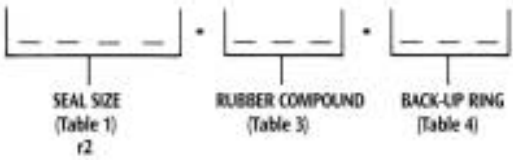


TABLE 2 6000 SERIES DIMENSIONAL INFORMATION (CONTINUED)

G-T Ring Part No. Prefix	Nominal Seal Size			Metal Dimensions		
	ID	OD	Cross-Section	Bore Diam. +.001" -.001"	Groove Diam. +.002" -.000"	Groove Length +.005" -.000"
6122	10 1/2	11	1/4	10.496	10.975	.366
6123	11	11 1/2	1/4	10.996	11.475	.366
6186	11 1/4	11 3/4	1/4	11.250	11.729	.366
6201	12	12 1/2	1/4	11.996	12.475	.366
6203	12 1/2	13	1/4	12.500	12.979	.366
6202	12 5/8	13 1/8	1/4	12.623	13.100	.366
6197	13	13 1/2	1/4	12.996	13.475	.366
6214	13 1/2	14	1/4	13.500	13.979	.366
6227	15 3/4	16 1/4	1/4	15.746	16.226	.366
6170	16 3/8	16 7/8	1/4	16.373	16.857	.366
6249	18 1/2	19	1/4	18.496	18.975	.366

TABLE 4 ANTI-EXTRUSION RING MATERIAL SELECTOR

Pressure (psi)	Clearance Limits	Recommended Anti-Extrusion Ring	Designator
0-3000	See Table 1 and Table 2	Virgin TFE	T
		Nylon-Wear Resistant	CN
		Graphite Filled TFE	P4
		Glass & MoS_2 Filled TFE	P5

For pressures above 3000 psi or temperatures above 275F, contact GTC Engineering Department for recommendations.

TABLE 3 ELASTOMERIC COMPOUND SELECTOR

SERVICE CONDITIONS FLUID	TEMP. RANGE	BASE POLYMER	DUROMETER HARDNESS (SHORE "A")	COMPOUND DESIGNATOR	COMPATIBLE NON-EXTRUSION RING MATERIAL
HYDRAULIC FLUIDS General purpose hydraulic oils, petroleum base lubricating oils, air, water, water-glycols, soluble oils	-40 to 300F (-40 to 149C)	NBR (Nitrile)	70	173	TFE, NWR
Water-glycol, ASTM oils #1,2,3,5	-65 to 325F (-54 to 163C)	PNF (Phosphonitrilic-fluoroelastomer	75	733	TFE, NWR
Silicone Oils	-40 to 300F (-40 to 149C)	NBR	70	173	TFE, NWR
FUELS Gasoline, Kerosene, Aircraft fuels	-65 to 160F (-54 to 72C)	NBR	70	160	TFE, NWR
	-20 to 400F (-29 to 204C)	FKM	70	731	TFE, NWR
BRAKE FLUIDS Automotive (SAE-J-1703)	-65 to 300F (-54 to 149C)	EPDM	70	801	TFE, NWR
ATF fluids, low aniline point oils	-40 to 300F (-40 to 149C)	NBR	70	700	TFE, NWR
GASES Refrigeration gases, freons	-40 to 250F (-40 to 121C)	CR	75	156	TFE, NWR
Nitrogen and most inert gases	-65 to 275F (-54 to 135C)	NBR	70	160	TFE, NWR
	-40 to 225F (-40 to 107C)	NBR	70	173	CN, T
	-20 to 350F (-29 to 175C)	FKM	70	731	CN, T
Chemicals, lubricating oils, solvents	-20 to 400F (-29 to 204C)	FKM	70	731	TFE, NWR

Greene Tweed
The Inside Advantage®

Greene Tweed
INDUSTRIAL GROUP

G-T® RINGS
10,000 Series · 12,000 Series
Technical Datasheet

G-T® RINGS
10,000 Series (Style #10)
12,000 Series (Style #12)

The unique G-T Ring provides a compact double acting seal for use in a new design for heavy duty applications where a more bulky type of seal had previously been required, as well as for retrofit in standard grooves designed for O-rings with two, one, or no backups.

This proven seal combines a tough, resilient, T-shaped sealing ring with precisely-dimensioned pressure actuated non-extrusion rings – for use with pressures ranging from zero to 10,000 psi and higher. Performance, reliability, and economy as a piston seal are unequaled – with

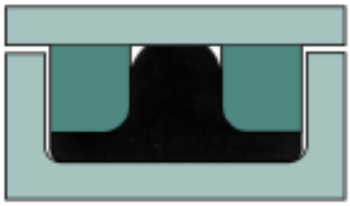


Figure 1

no piston drift with minimum piston length. This seal eliminates two major sealing problems: 1) the G-T Ring sealing element is protected from extrusion so that it seals satisfactorily when clearances must be abnormally large or where pressures are high, 2) the unique G-T Ring configuration presents seal roll and spiral failure. (See Fig. 1)

The G-T Ring is a piston, rod or static seal for use in cylinders, intensifies, accumulators, spool valves, and other demanding fluid power applications. It is currently specified for critical applications on all major jet aircraft (both military and commercial), sealing accumulators, reservoirs, actuators, valves, and the most rugged landing gear shock strut applications.

For more than 25 years the G-T Ring has been used by the Ordnance Department as the primary seal in recoil systems and by designers to solve their most severe sealing problems encountered in a wide variety of industrial and mobile equipment - including rough terrain lift trucks, front end loaders, tractors, back hoes, excavators, graders, cranes, jacks, oil field valves and well heads, and machine tools.

EXTRUSION RESISTANCE

The G-T design resists extrusion by preventing the elastomeric sealing element from wedging into the diametral clearances, or pinching off under motion or pressure. Under pressure, the resilent T-shaped elastometric-sealing element performs transmitting hydraulic pressure "down stream". This causes radial swelling or expansion of the flange under the non-extrusion backup ring on the low-pressure side of the assembly (See Fig. 2). The skive cut in the non-extrusion ring permits instantaneous radial movement into positive contract with the cylinder bore or rod being sealed, closing the clearance gap before any extension of the sealing element can occur.

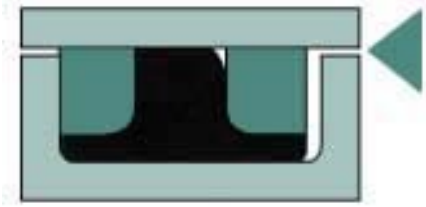


Figure 2

Since the non-extrusion rings do not rely on axial compression to radially expand, but are moved radially by hydro-mechanical action, they need not be made of easily deformed material. Rather they can be made of durable, low friction material with high shear strength and high resistance to cold flow, which results in superior resistance to extrusion. These pressure activated non-extrusion rings successfully bridge the large clearance incident to the use of wear rings – and protect the seal both from extrusion and contamination. As radial loading of the non-extrusion rings varies directly with fluid pressure, seal friction is

kept to a minimum during the low-pressure portion of the pressure cycle.

RESISTANCE TO ROLL

The seal is installed in the groove on a flat stable, static base. The non-extrusive rings complete the rectangular shape of the seal assembly and "lock" the T-shaped sealing element in position so that it is restrained from rolling around its circumference axis. The G-T ring cannot roll, twist or spiral {See Fig.3) and therefore, it is not subject to this mode of failure.

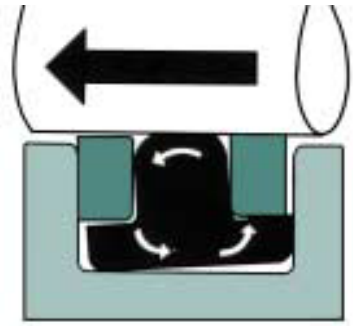


Figure 3

WEAR AND COMPRESSION SET

Since the G-T non-extrusion ring prevents extrusion and spiraling of the elastomeric sealing element, it is not necessary to sacrifice desirable wear resistance or low compression set characteristics by selecting a harder compound for its resistance to extrusion, even at high pressures. Wear resistant compounds with low compression set are available for virtually any operating environment for which G-T Rings are recommended.

G-T Ring design features which prevent roll of the seal (See Fig. 3), also lock the dynamic sealing surface in place so the seal cannot twist or move axially when it is pressurized. The plance of sealing contact is maintained as pressure builds and the piston and rod move. It is this constant sealing surface contact throughout the entire stroke that prevents a leakage even when the elastomer may have taken some compression set or some wear has occurred.

LOW PRESSURE SEALING

The G-T Ring is dimensioned so that the sealing element is installed with seal "squeeze" balanced between static and dynamic surfaces, thus providing a positive seal even at zero and low-pressure differential across the seal.

EFFECTIVE SERVICE LIFE

Style #12 (Fig. 4) offers the ultimate in G-T Ring performance. The matting radil at the intersection of the dynamic sealing element and the non-extrusion ring actuating flanges reduce tenile stresses, which can occur at this location (See Fig. 2) when the seal is pressurized. These radii also permit even and quick flow of material into the flange when pressure is applied which results in extremely fast response of the non-extrusion ring to close the extrusion gap.

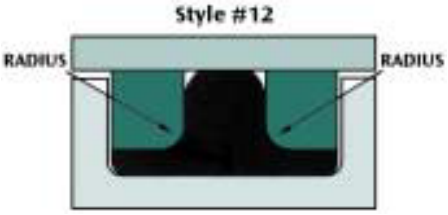


Figure 4

Application Recommendations

CLEARANCES

Even though clearances should be reduced to a practical minimum in applications where pressures are 3000 psi or higher, the outstanding capability of the G-T Ring to bridge the extension gap permits its use with clearances commonly encountered where bearing elements are included in the cylinder design or where there is side loading or piston and rod "lay down" (See Table 4).

TEMPERATURE AND FLUID

Suitable materials are available for use with all currently used hydraulic fluids in temperature ranges from minus 65° to 500°. The G-T Ring correctly applied, provides long useful life in the proper hydraulic fluid.

MOTION

The G-T Ring is used against either constant or impulsed pressure, as a dynamic seal where there is reciprocating motion. Or as a static seal. It is also used successfully against intermittent oscillating motion, as in swivel joints.

SURFACE FINISHES

Rod or cylinder surfaces should have a standard finish of 12 to 16 micro inches (rms). At pressures above 5,000 psi service life can be prolonged by reducing surface roughness to 10-12 micro inches.

For rod or piston grooves, a good-machined finish of 32 micro inches is recommended.

INSTALLATION

The G-T Ring assembly installs quickly and easily (without tools) into the same single groove recommended for an O-ring or an O-ring with backups. The usual installation consists of one seal assembly per piston or rod, in special situations where two or more seals are used such as an accumulator piston) it is recommended that the space between the rings be vented.

How to Select the Proper Seal

(Refer to Aerospace GT-Ring Catalog for aircraft applications)

STYLE

Two basic G-T Ring styles are available, the #12 and #10 Styles. For ultimate performance and/or service life, Style #12 radiused G-T Rings should be selected. This seal is especially recommended for use in high-pressure hydraulic systems, for systems that develop high-pressure spikes, or where rapid, accelerated motion or rapid pressure reversals occur. Style #12 radiused G-T Ring is an advanced concept originally developed to meet the rigorous sealing requirements of jet aircraft hydraulic and landing gear systems. Since their introduction, the seal have demonstrated their superiority in thousands of aerospace and industrial applications.

For less demanding applications Style #10 non-radiused G-T Rings (See Fig. 5) are suitable. This G-T Ring incorporates the basic G-T Ring geometry that has been used with great success in a variety of fluid power components for more than 30 years. In all static applications, Style #10 G-T Rings are recommended.

SEAL WIDTH

Three seal widths are available – wide, intermediate, and narrow. In rugged hydraulic applications, the heavy-duty wide base G-T Ring is designed to function in a groove that can accommodate a O-ring with two backup rings. The wide base G-T Ring has maximum stability in the groove, the largest sealing surface, and heavy non-extrusion backup rings which make them suitable for relatively high pressure, high clearance conditions, even when considerable side loading occurs.

In all piston accumulator applications, the heavy-duty wide base G-T Ring is recommended.

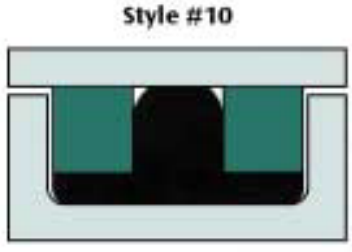
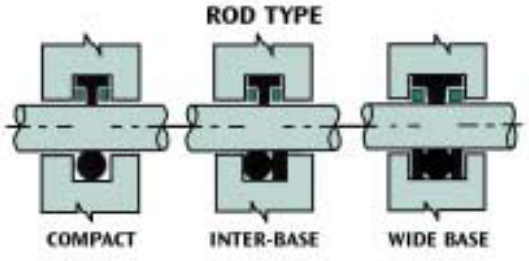


Figure 5

When minimal axial length is of particular importance, the compact narrow base G-T Ring should be selected. The seal assembly is designed to function in a groove that can accommodate an O-ring without backups.

The intermediate base G-T Ring may be selected for use in a groove that accommodates an O-ring with one backup.



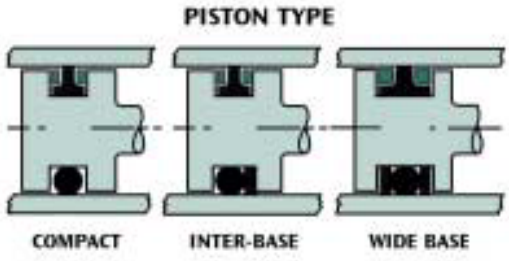


TABLE I ELASTOMERIC COMPOUND SELECTOR

SERVICE CONDITIONS FLUID	TEMP. RANGE	BASE POLYMER	DUROMETER HARDNESS (SHORE "A")	COMPOUND DESIGNATOR	COMPATIBLE NON-EXTRUSION RING MATERIAL*
HYDRAULIC FLUIDS					
General purpose hydraulic oils petroleum base lubricating oils, air, water, water-glycols, soluble oils	-40 to 300F	NBR (Nitrile)	70	173	TFE, NWR
Water-glycol, ASTM oils #1, 2, 3, 5	-65 to 325F	FZ	75	733	TFE, NWR
MIL-H-5606	-65 to 275F	NBR	70	160	TFE, NWR
MIL-H-6083	-65 to 325F	FZ	75	733	TFE, NWR
MIL-L-23699, MIL-L-7808	-65 to 325F	FZ	75	732	TFE, NWR
			90	734	
	-20 to 450F	FKM	70	731	TFE, NWR
	-40 to 450F	(Fluoroelastomer)	70	777	TFE, NWR, P-4
Silicone Oils	-40 to 300F	NBR	70	173	TFE, NWR
	-65 to 300F	EPR (Ethylene propylene)	80	952	TFE, NWR
	-65 to 325F	FZ	75	733	TFE, NWR
Oronite* 8200, Oronite 8515	-65 to 275F	CR (Chloroprene)	80	253	TFE, NWR
Pydraul 10E/29E, Furquel	-65 to 250F	EPDM (Ethylene propylene diene terpolymer)	70	801	TFE, NWR
	-65 to 375F	FZ	75	733	
Pydraul 30E, 50E, 90E, 115E	-20 to 400F	FKM	75	731	TFE, NWR
	-65 to 325F	FZ	75	733	
FUELS					
Gasoline, Kerosene, Aircraft Fuels	-65 to 160F	NBR	70	160	TFE, NWR
	-20 to 400F	FKM	75	731	
ASTM Fuels A, B, C	-65 to 325F	FZ	75	732	TFE, NWR
			90	734	
BRAKE FLUIDS					
Automotive (SAE-J-1703)	-65 to 300F	EPDM	70	801	TFE, NWR
		EPR	80	952	
Petroleum, Silicone	-65 to 325F	FZ	75	733	
ATF Fluids, low aniline point oils	-40 to 300F	NBR	70	700	TFE, NWR
	-65 to 325F	FZ	75	733	
GASES					
Refrigeration gases, freons	-40 to 250F	CR	75	156	TFE, NWR
Nitrogen and most inert gases	-65 to 275F	NBR	70	160	TFE, NWR
	-40 to 225F	NBR	70	173	
	-20 to 350F	FKM	75	731	
Chemicals, lubricating oils, solvents	-20 to 400F	FKM	75	731	TFE, NWR
Well-drilling fluids, petroleum-based fluids, good low temperature service	-60 to 250F	CO (Epichlorohydrin)	80	957	TFE, NWR, P-9
Hot water amines, H_2S (Very low permeability material)	+32 to 450F	FLUORAZ (Tetrafluoroethylene-propylene Elastomer)	75	797	TFE, NWR, P-9
			90	799	

**TFE: Virgin or filled to GTC spec.*

Refer to Table 4. Select appropriate size designation based on groove and rod of bore dimensions, which are applicable.

MATERIAL SELECTION

Select the proper compound and backup material from Table 1, compatible with the fluid to be sealed and the temperature range anticipated. This table coverts the most frequently encountered fluids and temperatures. It is recommended that realistic rather than arbitrary temperature ranges be used. These recommendations are based on normal operating conditions within the temperature ranges.

NON-EXTRUSION (BACKUP) RINGS

Select the specific materials from Table 2 based on pressure range, temperature range, maximum diametral clearance anticipated, and seal width selected. With extrusion of the seal through a clearance gap as the most predominant cause of seal failure, it is essential that you use realistic estimates of pressure spikes and maximum clearances under side loading and letdown conditions.

GREENE, TWEED G-TL RING FOR UNI-DIRECTIONAL SEALING

G-TL Rings provide unidirectional sealing when used in "Compact, Narrow Base" glands (Table 4). Their backup rings are generally thicker than backups used with G-T Rings and therefore should withstand slightly higher pressures and diametral clearances. Axial length of the elastomeric sealing element is increased; this provides more sealing surface.

Part numbering system for the G-TL Ring follows the same pattern as for the G-T Ring except for the third digit (seal configuration); the digit "7" should be used for rod-type or the digit "8" for piston-type (See Table 3); G-T Rings can be designed for other gland lengths and cross-sections as well as non-standard diameters. Greene, Tweed Engineering should be consulted for such designs.

TABLE 2 ANTI-EXTRUSION RING MATERIAL SELECTOR

PRESSURE (psi)	CLEARANCE LIMITS	RECOMMENDED ANTI-EXTRUSION MATERIAL*	DESIGNATOR	COMMENTS
0-3000	See Table 4	Virgin TFE	005	
		NWR	006	Includes balanced designed clearances to .025" diametral (i.e., with wear rings).
		P5	021	
		P4	016	Thin wall cylinder breathing to .012", diametral clearance.
3000-4500	to .025" diametral	NWR	006	1. Relatively balanced actuator system, even stroke with intermittent side loading and lay down. 2. Static applications.
	From Table 4 to .030 diametral	†Staged Virgin TFE & NWR 12 Series 10 Series	 050 060	1. Heavy Duty Wide Base Seal only. 2. Heavy stock load system with clearance due to cylinder distortion.
	See Table 4	P5	021	
Extreme Pressures	See Table 4	P9	045	Recommended for service extremes (temperatures to 450°F)

***Material** TFE: to MIL-R-8791 NWR: Wear Resistant Nylon to L-P-410a
P4: Graphite filled TFE to GTC spec. P5: Glass and MoS_2 filled TFE to GTC spec. P9: Polyetheretherketone to GTC spec.

†Assembly includes 4 backups. . . 1 TFE backup each side adjacent to rubber sealing element; 1 NWR backup each side adjacent to groove wall.

(Unless otherwise indicated, for temperatures above 275°F, contact GTC for Backup Material selection.)

TABLE 3 SEAL CONFIGURATION

AXIAL LENGTH	SEAL TYPE	DESIGNATOR
Narrow Base	Rod	1
	Piston	2
Inter Base	Rod	3
	Piston	4
Wide Base	Rod	5
	Piston	6
Narrow Base	Rod GTL	7
	Piston GTL	8

ROD SEAL

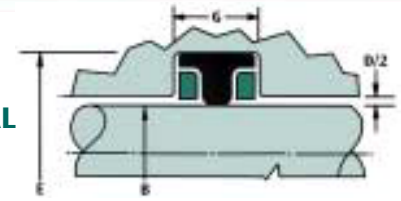
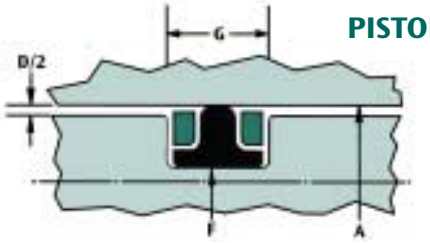


TABLE 4 DIMENSIONAL INFORMATION

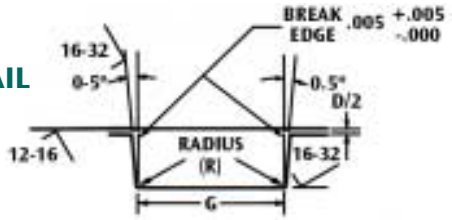
AS 568-A Uniform O-Ring Dash No.	Nominal Cross-Section	PISTON TYPE A Bore Dia.	PISTON TYPE F Gland Dia.	ROD TYPE B Rod Dia.	ROD TYPE E Gland Dia.	D Diametral Clearance	R Radius	G GLAND WIDTH (+.010 -.000) Compact Narrow Base	G GLAND WIDTH (+.010 -.000) Inter. Base	G GLAND WIDTH (+.010 -.000) Heavy Duty Wide Base
006		.250	.138	.124	.236					
007		.281	.169	.155	.267					
008	1/16"	.312	.200	.186	.298					
009	(.070)	.344 +.001 -.000	.232 +.000 -.001	.218 +.000 -.001	.330 +.001 -.000	.004		.094	.149	.207
010	±.003	.375	.263	.249	.361					
011		.437	.325	.311	.423					
012		.500	.388	.374	.486		.005			
110		.562	.384	.374	.552		TO			
111		.625	.447	.436	.614		.015			
112	3/32"	.687	.509	.499	.677					
113	(.103)	.750	.572	.561	.739			.141	.183	.245
114	±.003	.812	.634	.624	.802					
115		.875	.697	.686	.864					
116		.937	.759	.749	.927					
210		1.000	.757	.748	.991					
211		1.063	.820	.810	1.053					
212		1.125	.882	.873	1.116	.005				
213		1.188	.945	.935	1.178					
214		1.250	1.007	.998	1.241					
215	1/8"	1.313	1.070	1.060	1.303		.010			
216	(.139)	1.375 +.002 -.000	1.132 +.000 -.002	1.123 +.000 -.002	1.366 +.002 -.000		TO	.188	.235	.304
217	±.004	1.438	1.195	1.185	1.428		.025			
218		1.500	1.257	1.248	1.491					
219		1.563	1.320	1.310	1.553					
220		1.625	1.382	1.373	1.616					
221		1.688	1.445	1.435	1.678					
222		1.750	1.507	1.498	1.741					
325		1.875	1.503	1.498	1.870					
326		2.000	1.628	1.623	1.995					
327		2.125	1.753	1.748	2.120					
328		2.250	1.878	1.873	2.245					
329		2.375	2.003	1.998	2.370					
330		2.500	2.128	2.123	2.495					
331		2.625	2.253	2.248	2.620					
332	3/16"	2.750	2.378	2.373	2.745		.020			
333	(.210)	2.875	2.503	2.498	2.870	.007	TO	.281	.334	.424
334	±.004	3.000	2.628	2.623	2.995		.035			
335		3.125	2.753	2.748	3.120					
336		3.250	2.878	2.873	3.245					
337		3.375	3.003	2.998	3.370					
338		3.500	3.128	3.123	3.495					
339		3.625	3.253	3.248	3.620					
340		3.750	3.378	3.373	3.745					
341		3.875	3.503	3.498	3.870					
342		4.000	3.628	3.623	3.995					

For metric-sized G-T rings, see Greene, Tweed's Metric G-T Ring catalog.

PISTON SEAL



GLAND DETAIL



AS 568-A Uniform O-Ring Dash No.	Nominal Cross-Section	PISTON TYPE A Bore Dia.	PISTON TYPE F Gland Dia.	ROD TYPE B Rod Dia.	ROD TYPE E Gland Dia.	D Dia metral Clearance	R Radius	G GLAND WIDTH (+.010 -.000) Compact Narrow Base	G GLAND WIDTH (+.010 -.000) Inter. Base	G GLAND WIDTH (+.010 -.000) Heavy Duty Wide Base
343		4.125	3.753	3.748	4.120					
344		4.250	3.878	3.873	4.245					
345	3/16"	4.375	4.003	3.998	4.370					
346	(.210)	4.500 +.002	4.128 +.000	4.123 +.000	4.495 +.002	.007		.280	.334	.424
347	±.005	4.625 -.000	4.253 -.002	4.248 -.002	4.620 -.000					
348		4.750	4.378	4.373	4.745					
349		4.875	4.503	4.496	4.870					
425		5.001	4.524	4.498	4.975					
426		5.126	4.649	4.623	5.100					
427		5.251	4.774	4.748	5.225					
428		5.376	4.899	4.873	5.350					
429		5.501	5.024	4.998	5.475					
430		5.626	5.149	5.123	5.600					
431		5.751	5.274	5.248	5.725					
432		5.876	5.399	5.373	5.850					
433		6.001	5.524	5.498	5.975					
434		6.126	5.649	5.623	6.100		.020			
435		6.251 +.003	5.774	5.748	6.225 +.003	.009	TO			
436		6.376 -.000	5.899	5.873	6.350 -.000		.035			
437		6.501	6.024	5.998	6.475					
438		6.751	6.274	6.248	6.725					
439		7.001	6.524	6.498	6.975					
440		7.251	6.774	6.748	7.225					
441		7.501	7.024	6.998	7.475					
442	1/4"	7.751	7.274 +.000	7.248 +.000	7.725					
443	(.275)	8.001	7.524 -.003	7.498 -.003	7.975			.375	.475	.579
444	±.006	8.251	7.774	7.748	8.225					
445		8.501	8.024	7.998	8.475					
446		9.001	8.524	8.498	8.975					
447		9.501	9.024	8.998	9.475					
448		10.001	9.524	9.498	9.975					
449		10.501	10.024	9.998	10.475					
450		11.001	10.524	10.498	10.975					
451		11.501	11.024	10.998	11.475					
452		12.001	11.524	11.498	11.975					
453		12.501 +.004	12.024	11.998	12.475 +.004	.010				
454		13.001 -.000	12.524	12.498	12.975 -.000					
455		13.501	13.024	12.998	13.475					
456		14.001	13.524	13.498	13.975					
457		14.501	14.024	13.998	14.475					
458		15.001	14.524	14.498	14.975					
459		15.501	15.024	14.998	15.475					
460		16.001	15.524	15.498	15.975					

*Gland details conform to MIL-G-5514F. For old standard gland lengths to MIL-P-5514B, GTC Style #11 is available where required.

Greene Tweed
INDUSTRIAL GROUP

G-T® RING
11,000 Series
Technical Datasheet

G-T® RINGS
11,000 Series (Style #11)

The unique G-T Ring provides a compact double-acting seal for use in new design for heavy duty applications where a more bulky type of seal had previously been required, as well as for retrofit in standard grooves designed for O-rings with two, one, or no backups.

This proven seal combines a tough, resilient, T-shaped sealing ring with precisely-dimensioned pressure actuated non-extrusion rings-for use with pressures ranging from zero to 10,000 psi and higher.

Performance, reliability, and economy as a piston seal are unequaled-with no piston drift, with minimum piston length. This seal eliminates two major sealing problems: 1) The G-T Ring sealing element is protected from extrusion so that it seals satisfactorily when clearances must be abnormally larger or where pressures are high; 2) The unique G-T Ring configuration prevents seal roll and spiral failure (See Fig. 1).

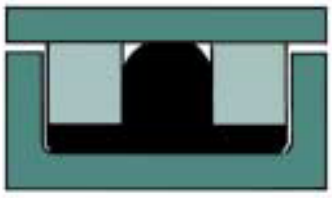


Figure 1

The G-T Ring is a piston, rod or static seal for use in cylinders, intensifiers, accumulators, spool valves, and other demanding fluid power applications. It is currently specified for critical applications on all major jet aircraft (both military and commercial), sealing accumulators, reservoirs, actuators, valves, and the most rugged landing gear shock strut applications. The 11,000 Series seals are designed to fit industrial O-ring glands incorporating nominal rod and bore diameters for zero, one and two backup widths per MIL-P-5514B.

EXTRUSION RESISTANCE

The G-T design resists extrusion by preventing the elastomeric sealing element from wedging into the diametral clearance, or pinching off under motion or pressure. Under pressure, the resilient T-shaped elastomeric sealing element deforms, transmitting hydraulic pressure "down stream." This causes radial swelling or expansion of the flange under the non-extrusion back-up ring on the low pressure side of the assembly (See Fig. 2).

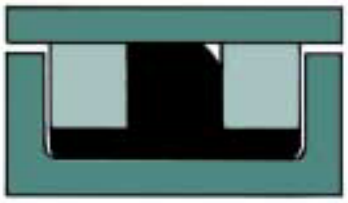


Figure 2

The skive cut in the non-extrusion ring permits instantaneous radial movement into positive contact with the cylinder bore or rod being sealed, closing the clearance gap before any extrusion of the sealing element can occur.

Since the non-extrusion rings do not rely on axial compression to radially expand, but are moved radially by hydro-mechanical action, they need not be made of easily deformed material. Rather, they can be made of durable, low friction material with high shear strength and high resistance to cold flow which results in superior resistance to extrusion. These pressure-activated non-extrusion rings successfully bridge the large clearance incident to the use of wear rings - and protect the seal both from extrusion and contamination. As radial loading of the non-extrusion rings varies directly with fluid pressure, seal friction is kept to a minimum during the low pressure portion of the pressure cycle.

RESISTANCE TO ROLL

The seal is installed in the groove on a flat stable, static base. The non-extrusion rings complete the rectangular shape of the seal assembly and "lock" the T-shaped sealing element in position so that it is restrained from rolling around its circumferential axis. The G-T Ring cannot roll, twist or spiral (See Fig. 3) and, therefore, it is not subject to this mode of failure.

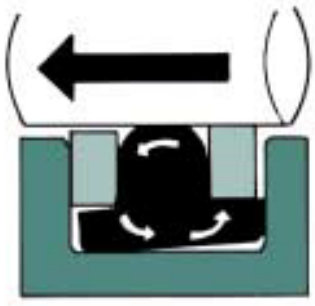


Figure 3

LOW PRESSURE SEALING

The G-T Ring is dimensioned so that the sealing element is installed with seal "squeeze" balanced between static and dynamic surfaces, thus providing a positive seal even at zero and low pressure differential across the seal.

TABLE 1 DIMENSIONAL INFORMATION

AS 568-A Uniform O-Ring Dash No.	Nominal Cross-Section	PISTON TYPE		ROD TYPE		D Diametral Clearance Max	R Radius	G GLAND WIDTH (+.005 -.000)		
		A BORE DIA.	F GLAND DIA.	B ROD DIA.	E GLAND DIA.			Compact, Narrow Base	Inter. Base	Heavy Duty Wide Base
106		.375 +.001	.196 +.000	.186 +.000	.365 -.000					
108		.437 -.000	.258 -.001	.249 -.001	.428 +.001					
109		.500	.321	.311	.490					
110	3/32"	.562	.384	.374	.552		.005			
111	(.103)	.625	.447	.436	.614		TO	.150	.171	.238
112	±.003	.687	.509	.499	.677		.015			
113		.750	.572	.561	.739					
114		.812	.634	.624	.802					
115		.875	.697	.686	.864					
116		.937	.759 +.000	.749 +.000	.927 +.002					
203		.562	.319 -.002	.311 -.002	.554 -.000					
204		.625	.382	.374	.617					
205		.687	.444	.436	.679					
206		.750 +.002	.507	.499	.742					
207		.812 -.000	.569	.561	.804		.010			
208		.875	.632	.624	.867		TO			
209		.937	.694	.686	.929		.025			
210		1.000	.757	.748	.991					
211		1.063	.820	.810	1.053	.005				
212	1/8"	1.125	.882	.873	1.116			.185	208	.275
213	(.139)	1.188	.945	.935	1.178					
214	±.004	1.250	1.007	.998	1.241					
215		1.313	1.070	1.060	1.303					
216		1.375	1.132	1.123	1.366					
217		1.438	1.195	1.185	1.428					
218		1.500	1.257	1.248	1.491					
219		1.563 +.002	1.320 +.000	1.310 +.000	1.553 +.002					
220		1.625 -.000	1.382 -.002	1.373 -.002	1.616 -.000					
221		1.688	1.445	1.435	1.678					
222		1.750	1.507	1.498	1.741					
325		1.875	1.503	1.498	1.870					
326		2.000	1.628	1.623	1.995					
327		2.125	1.753	1.748	2.120					
328		2.250	1.878	1.873	2.245					
329		2.375	2.003	1.998	2.370					
330		2.500	2.128	2.123	2.495					
331		2.625	2.253	2.248	2.620					
332		2.750	2.378	2.373	2.745		.020			
333	3/16"	2.875	2.503	2.498	2.870	.007	TO	.280	.311	.410
334	(.210)	3.000	2.628	2.623	2.995		.035			
335	±.004	3.125	2.753	2.748	3.120					
336		3.250	2.878	2.873	3.245					
337		3.375	3.003	2.998	3.370					
338		3.500	3.128	3.123	3.495					
339		3.625	3.253	3.248	3.620					
340		3.750	3.378	3.373	3.745					
341		3.875	3.503	3.498	3.870					
342		4.000	3.628	3.623	3.995					

TABLE 1 DIMENSIONAL INFORMATION (Continued)

AS 568-A Uniform O-Ring Dash No.	Nominal Cross-Section	PISTON TYPE		ROD TYPE		D Diametral Clearance Max	R Radius	G GLAND WIDTH (+.005 -.000)		
		A BORE DIA.	F GLAND DIA.	B ROD DIA.	E GLAND DIA.			Compact, Narrow Base	Inter. Base	Heavy Duty Wide Base
343		4.125	3.753	3.748	4.120					
344		4.250	3.878	3.873	4.245					
345	3/16"	4.375 +.002	4.003 +.000	3.998 +.000	4.370 +.002					
346	(.210)	4.500 -.000	4.128 -.002	4.123 -.002	4.495 -.000	.007		.280	.311	.410
347	±.005	4.625	4.253	4.248	4.620					
348		4.750	4.378	4.373	4.745					
349		4.875	4.503	4.498	4.870					
425		5.001	4.524	4.498	4.975					
426		5.126	4.649	4.623	5.100					
427		5.251	4.774	4.748	5.225					
428		5.376	4.899	4.873	5.350					
429		5.501	5.024	4.998	5.475					
430		5.626	5.149	5.123	5.600					
431		5.751	5.274	5.248	5.725					
432		5.876	5.399	5.373	5.850					
433		6.001	5.524	5.498	5.975					
434		6.126	5.649	5.623	6.100		.020			
435		6.251 +.003	5.774	5.748	6.225 +.003		TO			
436		6.376 -.000	5.899	5.873	6.350 -.000	.009	.035			
437		6.501	6.024	5.998	6.475					
438	1/4"	6.751	6.274 +.000	6.248 +.000	6.725					
439	(.275)	7.001	6.524 -.003	6.498 -.003	6.975			.366	.408	.538
440	±.006	7.251	6.774	6.748	7.225					
441		7.501	7.024	6.998	7.475					
442		7.751	7.274	7.248	7.725					
443		8.001	7.524	7.498	7.975					
444		8.251	7.774	7.748	8.225					
445		8.501	8.024	7.998	8.475					
446		9.001	8.524	8.498	8.975					
447		9.501	9.024	8.998	9.475					
448		10.001	9.524	9.498	9.975					
449		10.501 +.004	10.024	9.998	10.475 +.004					
450		11.001 -.000	10.524	10.498	10.975 -.000	.010				
451		11.501	11.024	10.998	11.475					
452		12.001	11.524	11.498	11.975					
453		12.501	12.024	11.998	12.475					
454		13.001	12.524	12.498	12.975					
455		13.501	13.024	12.998	13.475					
456		14.001	13.524	13.498	13.975					
457		14.501	14.024	13.998	14.475					
458		15.001	14.524	14.498	14.975					
459		15.501	15.024	14.998	15.475					
460		16.001	15.524	15.498	15.975					

TABLE 2 ELASTOMERIC COMPOUND SELECTOR

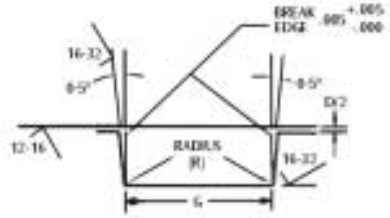
Fluids	Base Polymer (ASTM Designator)	Temperature Range (Degrees F)	Durometer Hardness (Shore A)	GTC Compound Designator	Application
General purpose hydraulic oils, mineral, oils petroleum based lubricants, air, water, water-glycols, soluble oils	NBR	-40 to +275	70	173	General Purpose
MIL-H-5606	NBR	-65 to +275	70	160	MIL-P-25732 as applicable
MIL-H-6083	NBR	-70 to +275	70	987	Low temperature Nitrile
	NBR	-65 to +275	75	964	MIL-P-83461 as applicable
	FZ	-70 to +300	70/80	737/738	MIL-P-87175 as applicable
MIL-H-83282	NBR	-65 to +275	75	964	MIL-P-83461 as applicable
MIL-H-46170	FZ	-70 to +300	70/80	737/738	MIL-P-87175 as applicable
Silicone Oils	EPR	-65 to +300	80	952	NAS-1613 as applicable
Phosphate esters, water-glycol cellulubes automotive brakefluids (SAE-J-1703	EPDM	-65 to +300	75	801	For use in FYRQUEL,PYDRAUL, PYROGARD and LINDOL type fluids
	EPR	-65 to +300	80	952	SKYDROL type phosphate/esterfluids NAS-1613 asapplicable
Automatic transmission fluids (ATF)	NBR	-40 to +275	70	700	Recommended for low aniline point oils
Gasoline, kerosene, aviation fuels	FKM	-20 to +450	75	731	MIL-R-83248 as applicable
JP fuels	FKM	-40 to +450	75	777	Low temperature FKM
	FZ	-65 to +300	70/80	740/741	AMS-7284 as applicable
Inert gases, nitrogen	NBR	-65 to +275	75	964	
	NBR	-65 to +275	75	972	Fluoromer treated elastomer for improved wear and low friction characteristics
Freon	CR	-65 to +275	80	253	Most freon gases
Synthetic hydrocarbons, silicate esters, diesters, solvents	FKM	-20 to +450	75	731	
	FKM	-40 to +450	75	777	Low temperature FKM
Steam, hot water	EPDM	-40 to +300	80	803	Can be used to 500 deg. F in non-oxidizing environment
	*TFE/P	+20 to +450	75	797	Recommended for use in steam systemswith corrosion inhibitors
Well drilling fluids, "sweet"crude oil brines	XNBR	-20 to +225	90	984	Tougher compound, abrasion resistance, suitable for downhole applications
	FKM	-20 to +450	75/90	731/927	
Well drilling fluids, "sour"crude oil, H_2S amines, steam,brines	*TFE/P	+20 to +450	75/90	797/799	90 durometer 799 compound recommended for explosive decompression resistance
	ECO	-50 to +300	80	957	Recommended for low temperature applications
Virtually all fluids and fluid combinations EXCEPT fluorinated solvents and alkali metals	FFKM	-20 to +450	75/90	505/510	

**ASTM designator not assigned at the time of this publication*
NOTE: Temperature ranges may vary depending on fluids and/or applications. Factors other than compatibility may alter the ideal compound recommendation. Consult GTC Product Engineering for confirmation of compound selection.

G-T® RING
11,000 Series

ROD SEAL

GLAND DETAIL



PISTON SEAL

TABLE 3 ANTI-EXTRUSION RING MATERIAL SELECTOR

Pressure (psi)	Clearance Limits	Recommended Anti-Extrusion Ring Material*	Designator	Comments
0-3000	See Table 1	Virgin TFE	005	
		NWR	013	Narrow Base Seal Only
		NWR	006	Includes balanced designed clearances to .025" diametral (i.e., with wear rings).
		P5	021	
		P4	016	Thin wall cylinder breathing to .012", diametral clearance.
3000-4500	to .025" diametral	NWR	006	1. Relatively balanced actuator system,even stroke with intermittent side loading and lay down. 2. Static applications
	From Table 1 to .030 diametral	†Staged Virgin TFE & NWR	060	1. Heavy Duty Wide Base Seal only. 2. Heavy shock load system with clearance due to cylinder distortion.
	See Table 1	P5	021	
Extreme Pressures	See Table 1	P9	045	Recommended for service extremes (temperatures to 450°F).

**Material*
TFE: to MIL-R-8791
NWR: Wear Resistant Nylon to L-P-410a
P4: Graphite filled TFE to GTC spec.
P5: Glass and MoS_2 filled TFE to GTC spec.
P9: Polyetheretherketone to GTC spec.

†Assembly includes 4 backups…1 TFE backup each side adjacent to rubber sealing element; 1 NWR backup each side adjacent to groove wall.

Unless otherwise indicated, for temperatures above 275°F, contact GTC for Backup Material selection.)

TABLE 4 SEAL CONFIGURATION

Axial Length	*Seal Type*	*Desig-nator*
Narrow Base	Rod	1
	Piston	2
Inter Base	Rod	3
	Piston	4
Wide Base	Rod	5
	Piston	6
Narrow Base	Rod GTL	7
	Piston GTL	8

GT-RING PART NUMBERING SYSTEM

Style No. | **Seal Configuration (See Table 4)** | **Seal Size Use 3-Digit Dash No. (Table 1)** | **Special Seal Size: 00=Std. 01-49=*** | **Elastomeric Compound Designator (Table 2)** | **Back-up Material Designator (Table 3)** | **Back-up Size: 0=Std. 1-9***

** Assigned by Greene, Tweed Engineering*

www.gtweed.com

Statements and recommendations in this publication are based on our experience and knowledge of typical applications for this product and shall not constitute a guarantee or warranty of performance nor a modification or alteration of our standard product warranty which shall be applicable to such products.

Greene Tweed
The Inside Advantage®

Greene Tweed
INDUSTRIAL GROUP

METRIC G-T® RING
13,000 Series · 14,000 Series
Technical Datasheet

METRIC G-T® RINGS
13,000 Series · 14,000 Series

The unique GT Ring provides a compact double-acting seal for use in new designs for light or heavy duty applications where a more bulky type of seal had previously been required.

This proven seal combines a tough, resilient, T-shaped sealing element with precisely dimensioned, pressure- activated non-extrusion rings (Figure 1) in applications where pressures may range to 690 bar (10,000 psi) or higher.

Figure 1

The seal eliminates several major sealing problems:

1. Sealing element is protected from extrusion where clearances are large or pressures are high,
2. Prevents spiral failure common to O-Rings, and
3. As non-extrusion rings are radially activated, they may be fabricated of materials with high shear strengths that will successfully bridge large clearance gaps encountered during high pressure cylinder breathing or incidental to use of wear rings. For more than 40 years, the GT Ring has been used by the Ordnance Department in recoil systems and by Industrial designers to solve their most severe sealing problems encountered in a wide variety of industrial, mobile and oil field requirements.

Utilize related ISO recommendations where appropriate as follows:
1. ISO/R286, tolerances (where suitable),
2. ISO 468, surface roughness, and
3. ISO 3286, Single Point Cutting tools-corner radii.

The sequential range of rod and bore diameters for each cross section are recommended for GT Seal type usage in dynamic applications only. Extension of range of diameters in each cross section group is possible but should be discussed with Greene, Tweed. For example, use of 1.78 mm cross section seal in a 20 mm dynamic piston application would not be recommended in favor of a 2.12 mm Cx seal.

PART NUMBER SELECTION, INDUSTRIAL DYNAMIC

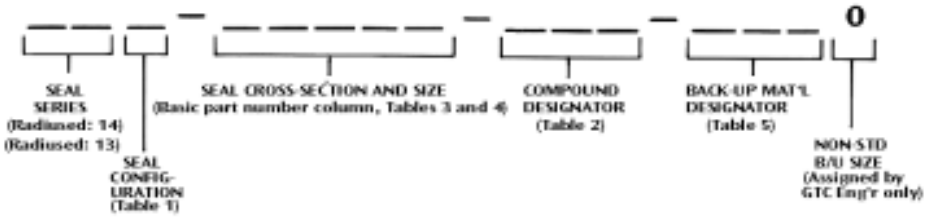


TABLE 1 SEAL CONFIGURATION

Axial Length	Seal Type	Designator
Narrow Base	Rod	1
	Piston	2
Inter Base	Rod	3
	Piston	4
Wide Base	Rod	5
	Piston	6
L-Ring (Narrow Base)	Rod	7
	Piston	8

Nom. Cross-Section (mm)	Designator (First digit of Basic Part number column)
1, 80	1
2, 65	2
3, 55	3
5, 30	5
7, 00	7

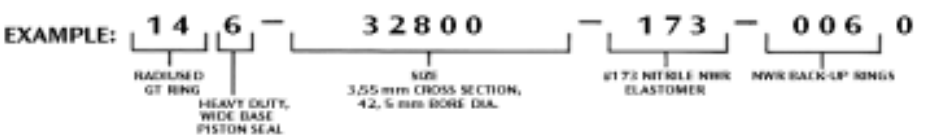


TABLE 2 ELASTOMERIC COMPOUND SELECTOR

Service Conditions			Durometer Hardness	Compound	Compatible Non-Extrusion
Fluid	Temp. Range	Base Polymer	(Shore "A")	Designator	Ring Material*
HYDRAULIC FLUIDS					
General purpose hydraulic oils,	-40 to 149°C	NBR (Nitrile)	70	173	TFE, NWR
petroleum base lubricating oils, air.	-40 to 107°C	AU (Urethane)	70	367	
Water, water-glycols, soluble oils	-40 to 100°C	NBR (Nitrile)	70	173	TFE
Water-glycol, ASTM oils #1,2,3,5	-54 to 163°C	FZ (was PNF) EYPEL Polyphosphazene	75	737	TFE, NWR
Silicone Oils	-40 to 149°C	NBR	70	173	TFE, NWR
	-54 to 149°C	EPR (Ethylene propylene)	80	952	TFE, NWR
	-54 to 163°C	FZ (was PNF)	75	737	
Pydraul 10E 29E, Fyrquel	-54 to 121°C	EPDM (Ethylene propylene diene terpolymer)	70	801	TFE, NWR, P5
	-54 to 163°C	FZ (was PNF)	75	733	
	-29 to 204°C	FKM	70	731	TFE, P5, P8
Pydraul 30E, 50E, 90E, 115E	-54 to 163°C	FZ (was PNF)	75	737	TFE, P4
FUELS	-54 to 71°C	NBR	70	160	TFE, NWR
Gasoline, Kerosene	-29 to 204°C	FKM	70	731	TFE, P5, P8
BRAKE FLUIDS	-54 to 121°C	EPDM	70	813	
Automotive (SAE-J-1703)	-54 to 149°C	EPR	80	952	TFE, P4
Petroleum, Silicone	-54 to 163°C	FZ (was PNF)	75	737	
ATF fluids, low aniline point oils	-40 to 149°C	NBR	70	700	TFE, NWR, P5
	-54 to 163°C	FZ (was PNF)	75	737	
GASES	-40 to 121°C	CR	75	156	TFE, NWR, P4
Refrigeration gases, freons	-54 to 135°C	NBR	70	160	
Nitrogen and most inert gases	-40 to 107°C	NBR	70	173	TFE, NWR, P4
	-29 to 175°C	FKM	70	731	
Chemicals, lubricating oils, solvents	-29 to 204°C	FKM	70	731	TFE, P8
Well-drilling fluids, petroleum-based fluids, good low temperature service	-51 to 121°C	CO (Epichlorohydrin)	80	957	TFE, NWR, P8
Steam, amines, H25 (sour gas). (Very low permeability material).	0 to 230°C	FLUORAZ™ (Tetrafluoro-ethylenepropylene Elastomer)	52 (Shore "D")	790	TFE, NWR, P8
			75	797	
			90	799	

**TFE: Virgin or filled to GTC spec.*

TABLE 3 PISTON TYPE DIMENSIONAL INFORMATION

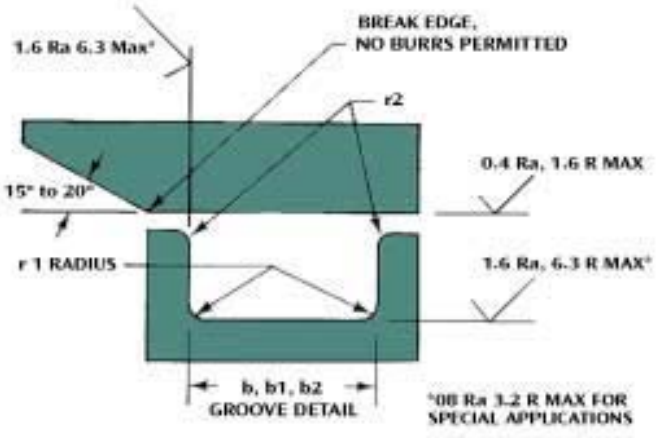
GTC CODE	Ød4		Ød3		Ød9**		GROOVE WIDTH G (+ .25/-.00)			RADII	
	Bore ID (mm)	Tolerance H8 (microns)	Gland OD (mm)	Tolerance h8 (microns)	Piston OD (mm)	Tolerance (microns)	b Narrow (mm)	b1 Inter (mm)	b2 Wide (mm)	r1 (mm)	r2 (mm)
10800	6.3	+ 22 / - 0	3.40	+ 0 / - 18	6.3	- 25 / - 61 (e9)	2.39*	3.78	5.26	0.3	0.1
10900	7		4.10		7					0.5	0.3
11000	8		5.10		8						
11100	9		6.10	+ 0 / - 22	9						
11200	*10		7.10		10						
11300	11	+ 27 / - 0	8.10		11	- 32 / - 75 (e9)					
11400	*12		9.10		12						
21400	*12		7.60		12		3.58	4.65	6.22	0.3	0.1
21500	13		8.60		13					0.5	0.3
21600	*14		9.60		14						
21700	15		10.60		15						
21800	*16		11.61	+ 0 / - 27	16						
21900	*18		13.61		18						
22000	*20	+ 33 / - 0	15.61		20	- 40 / - 92 (e9)					
22100	21		16.61		21						
22200	*22		17.61		22						
22300	23		18.61		23						
32200	*22		15.99	+ 0 / - 33	22	- 20 / - 72 (f9)	4.78	5.97	7.72	0.4	0.1
32300	23		16.99		23					0.8	0.3
32400	*25		18.99		25						
32500	27		20.99		27						
32600	28		21.99		28						
32700	30		23.99		30						
32800	*32	+ 39 / - 0	26.00		32	- 25 / - 87 (f9)					
32900	33		27.00		33						
33000	35		29.00		35						
33100	*36		30.00		36						
33200	38		32.00	+ 0 / - 39	38						
33300	*40		34.00		40						
33400	42		36.00		42						
33500	*45		39.00		45						
53500	*45	+ 39 / - 0	35.78	+ 0 / - 39			7.14	8.48	10.77	0.4	0.1
53600	48		38.78		48	- 25 / - 87 (f9)				0.8	0.3
53700	*50		40.78		50						
53800	55	+ 46 / - 0	45.78		55	- 30 / - 104 (f9)					
53900	*56		46.78		56						
54000	60		50.79	+ 0 / - 46	60						
54100	*63		53.79		63						
54200	65		55.79		65						
54300	70		60.79		70						
54400	75		65.79		75						
54500	*80		70.79		80						
54600	85	+ 54 / - 0	75.79		85	- 36 / - 123 (e9)					
54700	*90		80.79	+ 0 / - 54	90						
54800	95		85.79		95						
54900	*100		90.79		100						
55000	105		95.79		105						
55100	*110		100.79		110						

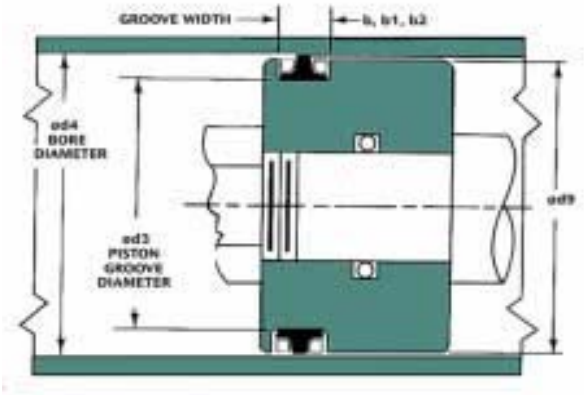
*Not Recommended if used, +0.13/-0 Groove Width Tolerance Recommended.
**Without Wear rings. For diameter with wear ring, refer to Bulletin WR187.

TABLE 3 PISTON TYPE DIMENSIONAL INFORMATION (CONTINUED)

GTC CODE	Ød4		Ød3		Ød9**		GROOVE WIDTH G (+ .25/-.00)			RADII	
	Bore ID (mm)	Tolerance H8 (microns)	Gland OD (mm)	Tolerance h8 (microns)	Piston OD (mm)	Tolerance (microns)	b Narrow (mm)	b1 Inter (mm)	b2 Wide (mm)	r1 (mm)	r2 (mm)
55200	115	+54 / -0	105.79	+0 / -54	115	- 36 / - 123 (e9)	7.14	8.48	10.77	0.4	0.1
55300	120		110.79		120					0.8	0.3
55400	*125	+ 63 / - 0	115.80		125	- 43 / - 106 (f8)					
55500	130		120.80		130						
55600	135		125.80		135						
75600	135		122.65	+ 0 / - 63	135		9.53	12.07	14.71	0.8	0.1
75700	*140		127.65		140					1.2	0.3
75900	150		137.65		150						
76100	*160		147.65		160						
76300	170		157.65		170						
76500	*180		167.65		180						
76700	190	+ 72 / - 0	177.65		190	- 50 / - 122 (f8)					
76900	*200		187.66	+ 0 / - 72	200						
77100	210		197.66		210						
77300	*220		207.66		220						
77400	225		212.66		225						
77500	230		217.66		230						
77600	235		222.66		235						
77900	*250		237.66		250						
78200	265	+ 81 / - 0	252.67	+ 0 / - 81	265	- 56 / - 137 (f8)					
78400	*280		267.67		280						
78600	300		387.67		300						
78700	*320	+ 89 / - 0	307.67		320	- 62 / - 151 (f8)					
78800	340		327.68	+ 0 / - 89	340						
78900	*360		347.68		360						
79000	380		367.68		380						
79100	*400		387.68		400						

**Not Recommended if used, +0.13/-0 Groove Width Tolerance Recommended.*
***Without Wear rings. For diameter with wear ring, refer to Bulletin WR187.*





Housing co-axiality tolerance: do not allow maximum co-axiality between Ød3 and Ød9 to exceed 0.025mm up to 50mm diameter or 0.05mm over 50mm diameter.

TABLE 4 ROD TYPE DIMENSIONAL INFORMATION

GTC CODE (mm)	d5 Rod OD (microns)	d5 Tolerance f8 (mm)	d6 Gland ID (microns)	d6 Tolerance H8 (mm)	d10** Housing ID (microns)	d10** Tolerance H8 (mm)	GROOVE WIDTH G (+ .25/-.00) b Narrow (mm)	b1 Inter (mm)	b2 Wide (mm)	RADII r1 (mm)	r2
10500	4	- 10	6.97	+ 22	4	+ 18	2.39*	3.78	5.26	0.2	0.1
10600	5	-28	7.97	- 0	5	- 0				0.4	0.3
10700	6		8.97		6						
10800	6.3	-13	9.27		6.3	+ 22					
10900	7	- 35	9.97		7	- 0					
11000	8		10.97	+ 27	8						
11100	9		11.97	- 0	9						
21200	*10		14.50		10		3.58	4.65	6.22	0.2	0.1
21300	11	- 16	15.50		11	+ 27				0.4	0.3
21400	*12	- 43	16.50		12	- 0					
21500	13		17.50		13						
21600	*14		18.50	+ 33	14						
21700	15		19.50	- 0	15						
21800	*16		20.50		16						
21900	*18		22.50		18						
32000	*20	- 20	26.07		20	+ 33	4.78	5.97	7.72	0.4	0.1
32100	21	- 53	27.07		21	- 0				0.8	0.3
32200	*22		28.07		22						
32300	23		29.07		23						
32400	*25		31.06	+ 39	25						
32500	27		33.06	- 0	27						
32600	28		34.06		28						
32700	30		36.06		30						
32800	*32	- 25	38.05		32	+ 39					
32900	33	- 64	39.05		33	- 0					
33000	35		41.05		35						
33100	36		42.05		36						
33200	38		44.05		38						
53300	*40		49.17		40		7.14	8.48	10.77	0.4	0.1
53400	42		51.17	+ 46	42					0.8	0.3
53500	45		54.17	- 0	45						
53600	48		57.17		48						
53700	*50		59.17		50						
53800	55	- 30	64.16		55	+ 46					
53900	56	- 76	65.16		56	- 0					
54000	60		69.16		60						
54100	*63		72.16		63						
54200	65	- 30	74.16	+ 46	65	+ 46	7.14	8.48	10.77	0.4	0.1
54300	70	- 76	79.16	- 0	70	- 0				0.8	0.3
54400	75		84.16	+ 54	75						
54500	*80		89.16	- 0	80						
54600	85	- 36	94.15		85	+ 54					
54700	90	- 90	99.15		90	- 0					
54800	95		104.15		95						
54900	*100		109.15		100						
55000	105		114.15		105						
55100	110		119.15		110						

**Not Recommended if used, +0.13/-0 Groove Width Tolerance Recommended.*
***Without Wear rings. For diameter with wear ring, refer to Bulletin WR187.*

TABLE 4 ROD TYPE DIMENSIONAL INFORMATION (CONTINUED)

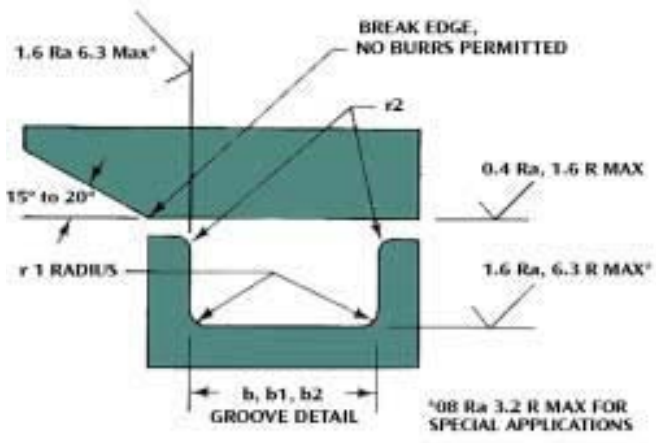
GTC CODE	Ød5		Ød6		Ød10**		GROOVE WIDTH G (+ .25/-.00)			RADII	
	Bore ID (mm)	Tolerance H8 (microns)	Gland OD (mm)	Tolerance h8 (microns)	Piston OD (mm)	Tolerance (microns)	b Narrow (mm)	b1 Inter (mm)	b2 Wide (mm)	r1 (mm)	r2 (mm)
75200	115		127.12	+ 63	115		9.53	12.07	14.71	0.8	0.1
75300	120		132.12	- 0	120					1.2	0.3
75400	*125	- 43	137.12		125	+ 63					
75500	130	- 106	142.12		130	- 0					
75600	135		147.12		135						
75700	140		152.12		140						
75800	145		157.12		145						
75900	150		162.12		150						
76000	155		167.12		155						
76100	*160		172.12		160						
76200	165		177.12		165						
76300	170		182.11	+ 72	170						
76400	175		187.11	- 0	175						
76500	180		192.11		180						
76600	185	- 50	197.10		185	+ 72					
76700	190	- 122	202.10		190	- 0					
76800	195		207.10		195						
76900	*200		212.10		200						
77000	205		217.10		205						
77100	210		222.10		210						
77200	215		227.10		215						
77300	220		232.10		220						
77400	225		237.10		225						
77500	230		242.10		230						
77600	235		247.10		235						
77700	240		252.09	+ 81	240						
77800	245		257.09	- 0	245						
77900	*250		262.09		250						
78000	255	- 56	267.09		255	+ 81					
78100	260	- 137	272.09		260	- 0					
78200	265		277.09		265						
78300	270		282.09		270						
78400	*280		292.09		280						
78500	290		302.09		290						
78600	300		312.09		300						
78700	*320	- 62	332.07	+ 89	320	+ 89					
78800	340	- 151	352.07	- 0	340	- 0					
78900	*360		372.07		360						
79000	380		392.07		380						
79100	*400		412.06	+ 97	400						
79200	425	- 68	437.05	- 0	425	+ 97					
79300	450	- 165	462.05		450	- 0					
79400	475		487.05		475						

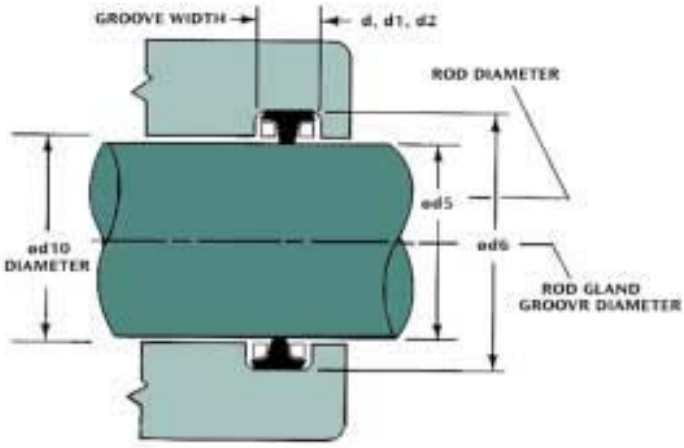
**Not Recommended if used, +0.13/-0 Groove Width Tolerance Recommended.*

***Without Wear rings. For diameter with wear ring, refer to Bulletin WR187.*

TABLE 5 ANTI-EXTRUSION RING MATERIAL SELECTOR

PRESSURE bar	CLEARANCE LIMITS mm	RECOMMENDED ANTI-EXTRUSION RING MATERIAL	DESIGNATOR
200	Without Wear Rings See Table 3 and 4	Virgin TFE: to MIL-R-8791 NWR: Wear Resistant Nylon to L-P-410a P4: Graphite filled TFE to GTC spec. P5: Glass and MoS_2 filled TFE to GTC spec.	005 006 021 016
	With Wear Rings 0.64 diametral clearance for 5.3 mm or 7.00 mm Cx Seals	NWR: Wear Resistant Nylon to L-P-410a P5: Glass and MoS_2 filled TFE to GTC spec.	006
200-350	Without Wear Rings See Tables 3 and 4	Staged Virgin TFE: to MIL-R-8791 NWR: Wear Resistant Nylon to L-P-410a P5: Glass and MoS_2 filled TFE to GTC spec.	 050 021
	With Wear Rings Contact GT Engineering	Staged Virgin TFE: to MIL-R-8791 NWR: Wear Resistant Nylon to L-P-410a P8: Arlon®	 038





Housing co-axiality tolerance: do not allow maximum co-axiality between $Ød_3$ and $Ød_9$ to exceed 0.025mm up to 50mm diameter or 0.05mm over 50mm diameter.

G-T® RING 32 SERIES

SEALING DESIGN SOLUTIONS

The unique G-T® Ring provides a compact double-acting seal for use in heavy-duty applications that previously required a more bulky type of seal, as well as for retrofit in standard grooves designed for O-rings with one, two or no backups.

This proven seal combines a tough, resilient, T-shaped sealing ring with precisely-dimensioned pressure actuated nonextrusion rings for use with pressures ranging from zero to 20,000 psi and higher.

Performance, reliability and economy as a piston seal are unequaled with no piston drift and minimum piston length. This seal eliminates two major sealing problems:

1. The G-T Ring sealing element is protected from extrusion so that it seals satisfactorily when clearances must be abnormally large or where pressures are high.
2. The unique G-T Ring configuration prevents seal roll and spiral failure.

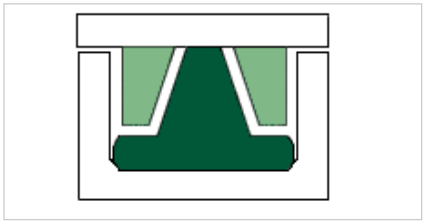


Figure 1

The G-T Ring is a piston, rod or static seal for use in service tools, logging tools, drilling tools, completion equipment, wellhead equipment, valves, accumulators, injection pumps, actuators, test equipment and other demanding oilfield applications.

Extrusion Resistance

The G-T design resists extrusion by preventing the elastomeric sealing element from wedging into the diametral clearance or pinching off under motion or pressure.

Under pressure, the resilient T-shaped elastomeric sealing element deforms, transmitting hydraulic pressure “down stream.”

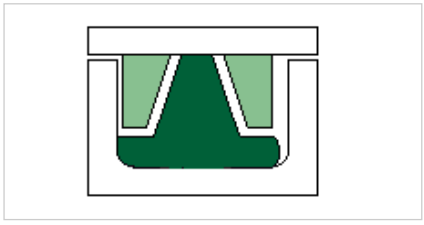


Figure 2

This causes radial swelling or expansion of the flange under the nonextrusion back-up ring on the low-pressure side of the assembly (see Figure 2).

The skive cut in the nonextrusion ring permits instantaneous radial movement into positive contact with the cylinder bore or rod being sealed, closing the clearance gap before any extrusion of the sealing element occurs.

Since the nonextrusion ring does not rely on axial compression to radially expand but is moved radially by hydro-mechanical action, it does not need to be made of easily deformed material. Rather, it can be made of durable, low friction material with high shear strength and high resistance to cold flow, resulting in superior resistance to extrusion. These pressure-activated nonextrusion rings successfully protect the seal both from extrusion and contamination. As radial loading of nonextrusion rings varies directly with fluid pressure, seal friction is kept to a minimum during the low pressure portion of the pressure cycle.

Resistance to Roll

The seal is installed in the groove on a flat, stable, static base. Two nonextrusion rings complete the rectangular shape of the seal assembly and “lock” the T-shaped sealing element in position so that it is restrained from rolling around the circumferential axis.

The G-T Ring cannot roll, twist and spiral (see figure 3) and, therefore, it is not subject to this mode of failure.

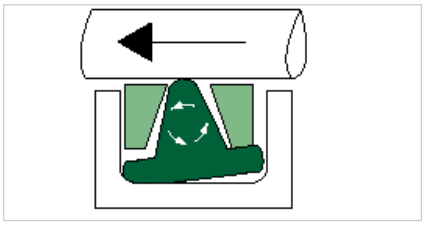


Figure 3

Since the G-T® nonextrusion ring prevents extrusion and spiraling of the elastomeric sealing element, it is not necessary to sacrifice desirable wear resistance or low compression set characteristics by selecting a harder compound for its resistance to extrusion, even at high pressures. Wear-resistant compounds with low compression set are available for virtually any operating environment for which G-T Rings are recommended.

G-T Ring design features that prevent roll of the seal (see Figure 3) also lock the dynamic sealing surface in place so the seal cannot twist or move axially when it is pressurized. The plane of sealing contact is maintained as pressure builds and the piston and rod move. It is the constant sealing surface contact throughout the entire stroke that prevents leakage.

Low-Pressure Sealing

The G-T Ring is dimensioned so that the sealing element is installed with seal "squeeze" balanced between static and dynamic surfaces, thus providing a positive seal even at zero and low-pressure differential across the seal.

Effective Service Life

Style #32 (see Figure 4) offers the ultimate in G-T Ring performance. The mating angles at the intersection of the dynamic sealing element and the nonextrusion ring actuating flanges reduce tensile stresses that can occur at this location (see Figure 2) when the seal is pressurized.

These radii also permit even and quick flow of material into the flange when pressure is applied, resulting in extremely fast response of the nonextrusion ring in the extrusion gap.

Clearances

Even though clearances should be reduced to a practical minimum in applications where pressures are 3,000 psi or higher, the outstanding capability of the G-T Ring to bridge the extrusion gap permits its use with high clearances due to design restrictions, cylinder expansion or where there is side loading (see Figure 4).

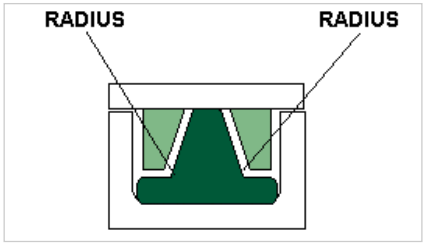


Figure 4

Temperature and Fluid

Suitable materials are available for use with all currently used hydraulic fluids in temperature ranges from -65°F to 500°F (-54°C to 260°C). The G-T Ring, correctly applied, provides long life in the proper hydraulic fluid.

Motion

The G-T Ring is used against either constant or impulsed pressure as a dynamic seal (where there is reciprocating motion) or as a static seal. It is also used successfully against intermittent oscillating motion, as in swivel joints.

Surface Finish

Rod or cylinder surfaces should have a standard finish of 12 – 16 microinches (rms). At pressure above 5,000 psi service life can be prolonged by reducing surface roughness to 10 – 12 microinches. For rod or piston grooves, a good machined finish of 32 microinches is recommended.

Installation

The G-T Ring assembly installs quickly and easily (without tools) into the same single groove recommended for an O-ring or an O-ring with backups. The usual installation consists of one seal assembly per piston or rod. In special situations where two or more seals are used (such as an accumulator piston) the space between the rings should be vented.

HOW TO SELECT THE PROPER SEAL

Style # 32

The G-T® Ring 32 series is especially recommended for high-pressure hydraulic systems, in systems that develop high-pressure spikes, or systems where rapid accelerated motion or rapid pressure reversals occur. The style #32 radiused G-T Ring is an advanced concept to meet the rigorous sealing requirements of the oilfield industry. Since their introduction, the seals have demonstrated their superiority in thousands of oilfield, industrial and aerospace applications.

Seal Width

Three seal widths are available—wide, intermediate and narrow. In rugged hydraulic applications, the heavy-duty, wide base G-T Ring should be selected. This G-T Ring is designed to function in the groove that can accommodate an O-ring with two backup rings. The wide base G-T Ring has maximum stability in the groove, the largest sealing surface, and heavy nonextrusion back-up rings that make them suitable for relatively high pressures and high clearance conditions.

Material Section

Greene Tweed offers engineering assistance with all your seal application decisions. We also assist with special designs for nonstandard glands and for all special equipment considerations.

When replacing an O-ring, the compact narrow base G-T Ring should be selected. This seal assembly is designed to function in a groove that normally accommodates an O-ring without backups.

02/05-GT DS-US-OF-031

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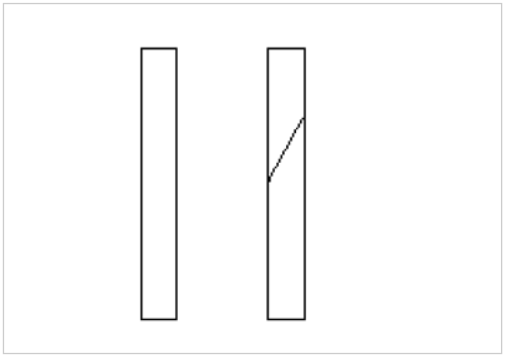
THERMOPLASTIC ANTI-EXTRUSION RINGS

Sealing Solutions for Demanding Environments

anti-extrusion rings \ product data

THERMOPLASTIC SOLUTIONS

Greene, Tweed recommends that back-up systems be used for pressures above 1,500 psi, dependent on temperature, extrusion gaps and surfaces finish. Anti-extrusion rings can be supplied in a wide variety of standard or special designs. Standard materials held in stock are listed below.



Arlon® (PEEK™)

A high-strength, 482°F (250°C) thermoplastic capable of withstanding steam and the aggressive conditions found downhole, Arlon resists virtually all organic and aqueous chemicals over a wide temperature range, with the exception of concentrated inorganic acids at high temperature. Arlon is highly wear resistant and tough while retaining its mechanical properties over a wide temperature range to (482°F, 250°C). Greene, Tweed supplies virgin grade Arlon and grades reinforced with glass, carbon fiber and TFE. Greene, Tweed has back-up systems working at up to 40,000 psi or more with its GT Seal configuration.

Re-enforced TFE

Chemically inert at elevated temperatures and pressures, reinforced TFE has outstanding resistance to nearly all oilfield environments. Temperatures from -450°F to 600°F (-268°C to 315°C) can be achieved; however, TFE has only fair resistance to deformation under load. Greene, Tweed utilizes fillers such as graphite or glass fiber to improve TFE's resistance to cold flow.

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03/05-GT DS-US-OF-028