Material Specifications

Nylon

Pressure Rating:

150 PSIG (10 BAR) NEMA 4x, 6 (Submersible) & 12 - IP 68 / IP 69K

Materials:

- Fittings: Nylon 6/6
- Form Seal: Buna-N
- Optional O-Ring: Buna-N, Viton® or Silicone
- Optional Seal Ring: Polyethylene or Fiber-Reinforced Plastic

Operating Temperature:

Nylon Fittings: - 40ºC to 100ºC (- 40ºF to 212ºF)
Nylon Fitting w/ Aluminum Clamp: - 20ºC to 70ºC (- 4ºF to 158ºF)

Available Colors:

- Black (RAL 9005)
- Gray (RAL 7035)
- Blue (RAL 5012) - upon request

Nylon 6/6: V0 rated - Flame resistant, halogen and phosphorous free, self-extinguishing, non-toxic, fungus resistant

Nickel Plated Brass

Pressure Rating:

150 PSIG (10 BAR) NEMA 4x, 6 (Submersible) & 12 - IP 68 / IP 69K

Materials:

- Fittings: Nickel Plated Brass
- Spring (Flex Extension): Stainless Steel
- Form Seal: Buna-N (NBR)
- Splined Bushing: Nylon 6/6
- O-Ring: Buna-N (Viton® or Silicone optional)
- Optional Seal Ring: Polyethylene or Fiber-Reinforced Plastic

Operating Temperature:

- 40ºC to 100ºC (- 40ºF to 212ºF)

Nylon 6/6: V0 rated - Flame resistant, halogen and phosphorous free, self extinguishing, non-toxic, fungus resistant

Nickel Plated Brass - WADI

Type	Operating Temperatures
• Mini WADI (Buna-N)	- 20ºC to 100ºC (- 4ºF to 212ºF)
• Mini WADI (Viton®)	- 25ºC to 200ºC (- 13ºF to 392ºF)
• WADI XL (Buna-N)	- 20ºC to 100ºC (- 4ºF to 212ºF)

Adapter, Reducer & Enlarger Materials

Materials	Operating Temperatures
• Nylon	- 40ºC to 80ºC (- 40ºF to 176ºF)
• Nickel Plated Brass	- 40ºC to 100ºC (- 40ºF to 212ºF)

V0 Flammability Rating according to UL 94
(applies to all Strain Relief Fittings)

RoHS Deca BDE

PVDF

Pressure Rating:

150 PSIG (10 BAR) NEMA 4x, 6 (Submersible) & 12 - IP 68 / IP 69K

Materials:

- Fittings: Teflon® or Nickel Plated Brass
- Form Seal: Viton® (FPM)
- Clamping Insert: PVDF
- O-Ring: Viton® (FPM)

Operating Temperature:

- 35ºC to 150ºC (- 31ºF to 302ºF), V0 rated

Resistant to:

- Acid
- Salt solution
- Oxydant
- Halogens
- Alcohols
- Chlorinated solvent
- Aliphatic hydrocarbons
- Petrol

Stainless Steel

Pressure Rating:

150 PSIG (10 BAR) NEMA 4x, 6 (Submersible) & 12 - IP 68 / IP 69K

Materials:

- Fittings: 303 Stainless Steel
- Form Seal: Buna-N (NBR) or Viton® (FPM)
- Clamping Insert: PA (Nylon) or PVDF
- O-Ring: Buna-N (FPM), Viton® or Silicone

Operating Temperature:

Buna-N: - 40ºC to 100ºC (- 40ºF to 212ºF)
PVDF: - 35ºC to 150ºC (- 31ºF to 302ºF)

Insert Materials

Materials	Operating Temperatures
• Buna-N	- 40ºC to 100ºC (- 40ºF to 212ºF)
• Elastomer	- 40ºC to 100ºC (- 40ºF to 212ºF)
• Viton® (FPM)	- 25ºC to 200ºC (- 13ºF to 392ºF)
• Silicone	- 60ºC to 250ºC (- 76ºF to 482ºF)

O-Ring & Seal Ring Materials

Materials	Operating Temperatures
• Buna-N	- 30ºC to 120ºC (- 22ºF to 248ºF)
• Viton® (FPM)	- 40ºC to 200ºC (- 40ºF to 392ºF)
• Silicone	- 60ºC to 250ºC (- 76ºF to 482ºF)
• Polyethylene	- 30ºC to 70ºC (- 22ºF to 158ºF)
• Fiber-reinforced Plastic	- 55ºC to 300ºC (- 67ºF to 572ºF)

UL/UR	E103997
CSA	074032
VDE	71339
CAGE	ZERO UE114
PATENT	4145075

Most of our standard products are also available in EEx e & ATEX versions!

ATEX

NEMA Ratings - Overview

NEMA stands for the National Electrical Manufacturers Association.
It has established a range of standards for electrical equipment enclosures.

NEMA 1 General Purpose - Indoors
Type 1 - intended for general purpose indoor use primarily to provide a degree of protection against contact with the enclosed equipment or locations where unusual service conditions do not exist.

NEMA 2 Drip Proof - Indoors
Type 2 - intended for general purpose indoor use primarily to provide a degree of protection against limited amounts of falling water and dirt.

NEMA 3 Dust Tight, Rain Tight, & Ice/Sleet resistant - Indoors/Outdoors
Type 3 - intended for general purpose outdoor use primarily to provide a degree of protection against windblown dust, rain, and sleet; and to be undamaged by the formation of ice on the enclosure.

NEMA 3R Rain Proof & Ice/Sleet Proof - Indoors/Outdoors
Type 3R - intended for general purpose outdoor use primarily to provide a degree of protection against falling rain; and to be undamaged by the formation of ice on the enclosure.

NEMA 3S Dust Tight, Rain Tight, & Ice/Sleet Proof - Outdoors
Type 3S - intended for general purpose outdoor use primarily to provide a degree of protection against sleet; and to be undamaged by the formation of ice on the enclosure.

NEMA 4 Water Tight & Dust Tight - Indoors/Outdoors
Type 4 - intended for general purpose indoor or outdoor use primarily to provide a degree of protection against windblown dust and rain, splashing water, and hose directed water; and to be undamaged by the formation of ice on the enclosure.

NEMA 4x Water Tight, Dust Tight, & Corrosion Resistant - Indoors/Outdoors
Type 4X - intended for general purpose indoor and outdoor use primarily to provide a degree of protection against corrosion, windblown dust and rain, splashing water, and hose-directed water; and to be undamaged by the formation of ice on the enclosure.

NEMA 5 Superseded by NEMA 12 for Control Apparatus
Type 5 - see NEMA 12

NEMA 6 Submersible, Water Tight, Dust Tight, & Ice/Sleet Resistant - Indoors/Outdoors
Type 6 - intended for general purpose indoor or outdoor use primarily to provide a degree of protection against the entry of water during temporary submersion at a limited depth; and to be undamaged by the formation of ice on the enclosure.

NEMA 6P Submersible, Water Tight, Dust Tight, & Ice/Sleet Resistant - Indoors/Outdoors
Type 6P - Same as NEMA 6 including protection against the entry of water during prolonged submersion at a limited depth.

NEMA 7 Underwriters Lab Class 1-Groups C&D -Explosion Proof - Indoors
Type 7 - for indoor use in locations classified as Class I, Groups A, B, C, or D, as defined in the National Electrical Code.
Type 7 enclosures shall be capable of withstanding the pressures resulting from an internal explosion of specified gases, and contain such an explosion sufficiently that an explosive gas-air mixture existing in the atmosphere surrounding the enclosure will not be ignited. Enclosed heat generating devices shall not cause external surfaces to reach temperatures capable of igniting explosive gas-air mixtures in the surrounding atmosphere. Enclosures shall meet explosion, hydro-static, and temperature design tests.

NEMA 8 Underwriters Lab Class 1-Groups C&D -Explosion Proof - Indoors
Type 8 is same as NEMA 7, except the unit is oil-immersed

NEMA 9 Underwriters' Lab Class II - Groups E, F, G - Indoors
Type 9 - intended for special purpose indoor use in locations classified as hazardous (Class II, Groups E, F, or G, as defined in the National Electrical Code).
Type 9 enclosures shall be capable of preventing the entrance of dust. Enclosed heat generating devices shall not cause external surfaces to reach temperatures capable of igniting or discoloring dust on the enclosure or igniting dust-air mixtures in the surrounding atmosphere. Enclosures shall meet dust penetration and temperature design tests, and aging of gaskets (if used).

NEMA 10 Bureau of Mines

NEMA 11 Corrosion Resistant & Drip Proof - Oil Immersed - Indoors

NEMA 12 Industrial Use - Dust Tight & Drip Tight - Indoors
Type 12 - intended for industrial indoor use primarily to provide a degree of protection against dust, falling dirt, and dripping noncorrosive liquids.

NEMA 13 Oil Tight & Dust Tight - Indoors
Type 13 - intended for industrial indoor use primarily to provide a degree of protection against dust, spraying of water, oil, and noncorrosive coolant.

NEMA Rating	NEMA 1	NEMA 2	NEMA 3	NEMA 3R	NEMA 3S	NEMA 4	NEMA 4x	NEMA 6	NEMA 6P	NEMA 12, 12K	NEMA 13
IP Class	IP 23	IP 30	IP 64	IP 32	IP 64	IP 66	IP 66	IP 66-68	IP 67-68	IP 65	IP 65
Indoor	✓	✓	-	-	-	-	-	-	-	✓	✓
Outdoor	-	-	✓	✓	✓	-	-	-	-	-	-
Indoor & Outdoor	-	-	-	-	-	✓	✓	✓	✓	-	-

IP Ratings

The IP Code defined in international standard IEC 60529 classifies the degrees of protection provided against the intrusion of:

- solid objects (including body parts like hands and fingers)
- dust
- accidental contact
- water in electrical enclosures

It consists of the letters IP (for “International Protection Rating” or “Ingress Protection Rating”) followed by two digits and an optional letter. The standard aims to provide users more detailed information than vague marketing terms such as “waterproof”.

Level	Object size protected against	Effective against
0	-	No protection against contact and ingress of objects
1	>50 mm	Any large surface of the body, such as the back of a hand, but no protection against deliberate contact with a body part
2	>12.5 mm	Fingers or similar objects
3	>2.5 mm	Tools, thick wires, etc.
4	>1 mm	Most wires, screws, etc.
5	dust protected	Ingress of dust is not entirely prevented, but it must not enter in sufficient quantity to interfere with the satisfactory operation of the equipment; complete protection against contact
6	dust tight	No ingress of dust; complete protection against contact

Level	Protected against	Details
0	not protected	-
1	dripping water	Dripping water (vertically falling drops) shall have no harmful effect.
2	dripping water when tilted up to 15°	Vertically dripping water shall have no harmful effect when the enclosure is tilted at an angle up to 15° from its normal position.
3	spraying water	Water falling as a spray at any angle up to 60° from the vertical shall have no harmful effect.
4	splashing water	Water splashing against the enclosure from any direction shall have no harmful effect.
5	water jets	Water projected by a nozzle against enclosure from any direction shall have no harmful effects.
6	powerful water jets	Water projected in powerful jets against the enclosure from any direction shall have no harmful effects.
7	immersion up to 1 m	Ingress of water in harmful quantity shall not be possible when the enclosure is immersed in water under defined conditions of pressure and time (up to 1 m of submersion).
8	immersion beyond 1 m	The equipment is suitable for continuous immersion in water under conditions which shall be specified by the manufacturer. NOTE: Normally, this will mean that the equipment is hermetically sealed. However, with certain types of equipment, it can mean that water can enter but only in such a manner that produces no harmful effects.

IP 69K

German standard DIN 40050-9 extends the IEC 60529 rating system described above with an IP 69K rating for high-pressure, high-temperature wash-down applications.
Such enclosures must not only be dust tight (IP 6X), but also able to withstand high-pressure and steam cleaning.
The test specifies a spray nozzle that is fed with 80 °C (176 °F) water at 8–10 MPa (80–100 bar) and a flow rate of 14–16 L/min.
The nozzle is held 10–15 cm (3.94” - 5.91”) from the tested device at angles of 0°, 30°, 60° and 90° for 30 seconds each.
The test device sits on a turntable that rotates once every 12 s (5 rpm).

The IP 69K test specification was initially developed for road vehicles, especially those that need regular intensive cleaning (dump trucks, cement mixers, etc), but also finds use in other areas (e.g., food industry, railroad, marine, etc.)

The most commonly used protection methods are IP and NEMA, whereas:
- IP Classification – addresses the European market
- NEMA Classification – addresses the North American market

Sizes & Dimensions for SEALCON Liquid Tight Strain Relief Fittings

Metric	Major Thread Diameter	Minor Thread Diameter	PG	Major Thread Diameter	Minor Thread Diameter	NPT	Major Thread Diameter	Minor Thread Diameter	Dome Opening
M6 x 1.0	6.0 mm / .24”	5.0 mm / .19”							3.0 mm / .11”
M8 x 1.25	8.0 mm / .31”	6.8 mm / .26”							5.0 mm / .19”
M10 x 1.5	10.0 mm / .40”	8.4 mm / .33”							6.0 mm / .24”
M12 1.5	12.0 mm / .47”	8.0 mm / .32”							6.5 mm / .26”
			PG 7	12.5 mm / .49”	11.3 mm / .44”	1/4”	12.5 mm / .49”	11.6 mm / .46”	6.5 mm / .26”
			PG 9	15.2 mm / .60”	13.9 mm / .54”	3/8”	16.8 mm / .66”	15.2 mm / .60”	8.0 mm / .31”
M16 x 1.5	16.0 mm / .63”	14.5 mm / .57”							8.0 mm / .31”
			PG 11	18.6 mm / .73”	17.3 mm / .68”				10.0 mm / .39”
M20 x 1.5	20.0 mm / .79”	18.5 mm / .72”							12.0 mm / .47”
			PG 13	20.4 mm / .80”	19.1 mm / .75”	1/2”	20.8 mm / .82”	18.8 mm / .74”	12.0 mm / .47”
			PG 16	22.5 mm / .89”	21.2 mm / .83”	1/2”-E	20.8 mm / .82”	18.8 mm / .74”	14.0 mm / .55”
M25 x 1.5	25.0 mm / .98”	23.5 mm / .92”							18.0 mm / .71”
			PG 21	28.3 mm / 1.11”	26.8 mm / 1.05”	3/4”	26.2 mm / 1.03”	24.1 mm / .95”	18.0 mm / .71”
M32 x 1.5	32.0 mm / 1.26”	30.5 mm / 1.20”							25.0 mm / 0.98”
			PG 29	37.0 mm / 1.46”	35.5 mm / 1.39”	1”	32.8 mm / 1.29”	30.5 mm / 1.20”	25.0 mm / 0.98”
						1-1/4”	41.4 mm / 1.63”	38.1 mm / 1.50”	25.0 mm / 0.98”
M40 x 1.5	40.0 mm / 1.57”	38.5 mm / 1.51”							32.0 mm / 1.26”
			PG 36	47.0 mm / 1.85”	45.5 mm / 1.79”	1-1/2”	47.8 mm / 1.88”	45.7 mm / 1.80”	32.0 mm / 1.26”
M50 x 1.5	50.0 mm / 1.97”	48.5 mm / 1.90”							38.0 mm / 1.50”
			PG 42	54.0 mm / 2.13”	52.5 mm / 2.13”				38.0 mm / 1.50”
			PG 48	59.3 mm / 2.33”	57.8 mm / 2.72”				44.0 mm / 1.73”
M63 x 1.5	63.0 mm / 2.48”	61.5 mm / 2.42”							44.0 mm / 1.73”

Determine Sizes & Type of Fitting:

1. Check markings on the hex portion (wrenching flats). PG, NPT or Metric size should be embedded. This only applies to Nylon parts.
2. Measure major thread diameter and compare with chart above. This may tell you whether it is a PG, NPT or Metric thread (Nylon or Brass)
3. Confirm grommet type inside fitting. (See table on right for grommet identification)
4. The shorter length fittings are CD’s (connector dome), the longer type are CF’s (connector flex).
5. We offer Enlarged as well as Reduced solutions. A PG13.5/16 has a PG13 thread with a PG16 body. Reduced would be the opposite (only in Nylon)
6. The shading (grouping) indicates same size bodies, but different threads.

Grommet Identification	
Color	Type of Grommet
Black	Standard
Gray	Reduced
Beige	Multi-Hole / Solid Plug
Green	Viton®
Brown	Silicone

NOTE:
Dome Opening = the largest possible dimension for one or more cables.
The chart can also be useful when working with knockouts (drilling holes)

Viton® is a federally registered trademark of DuPont Dow Elastomer.

Recommended Torque Specifications for Strain Relief Fittings

Sizes	Torque in inlb (Nm)			
	Plastic Fittings		Metal Fittings	
	Dome Nuts	Thread & Lock Nuts	Dome Nuts	Thread & Lock Nuts
PG7, M12x1.5	14.4 (1.62)	22.1 (2.5)	36.9 (4.17)	55.3 (6.25)
PG9, PG11, PG13, 3/8”NPT, 1/2”NPT, M16x1.5, M20x1.5	22.1 (2.5)	33.2 (3.75)	36.9 (4.17)	55.3 (6.25)
PG16, 1/2”NPT-E	29.5 (3.33)	44.2 (5)	44.2 (5)	66.4 (7.5)
PG21, PG29, PG36, PG42, PG48, 3/4”NPT, 1”NPT, 1-1/4”NPT, 1-1/2”NPT, M25, M32, M40, M50, M63	44.2 (5)	66.4 (7.5)	59 (6.67)	88.5 (10)

Note: Torque for dome nuts was determined using a metal rod. It may vary for cable, depending on the crush resistance of the cable. We recommend to determine the actual torque empirically, testing the actual cable used. The values shown above are for reference only.

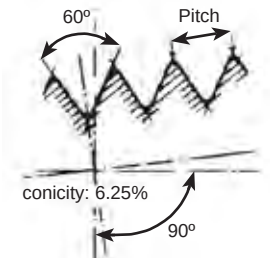
Pull-Test Rating for Strain Relief Fittings

The Pull-Test Rating of our Strain Relief Fittings complies with Industry Standards.
Pull-Test Rating: 35 lb.

Thread Specifications

NPT Threads

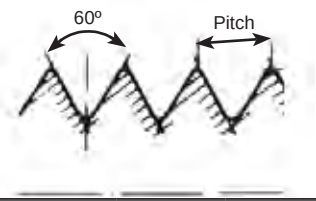
Thread Size	1/4" NPT	3/8" NPT	1/2" NPT	3/4" NPT	1" NPT	1-1/4" NPT	1-1/2" NPT	2" NPT
Major Dia. in Inches (mm)	.54 (13.72)	.69 (17.15)	.84 (21.34)	1.05 (26.67)	1.32 (33.40)	1.66 (42.16)	1.90 (48.26)	2.38 (60.33)
Pitch in Inches (mm)	.056 (1.41)	.056 (1.41)	.071 (1.81)	.071 (1.81)	.087 (2.21)	.087 (2.21)	.087 (2.21)	.087 (2.21)
Threads per Inch	18	18	14	14	11.5	11.5	11.5	11.5



- NPT Thread = National Pipe Thread
- Taper rate for all NPT threads is 1/16
- The taper on NPT threads allows them to form a seal when torqued as the flanks of the threads compress against each other, as opposed to straight thread fittings

Metric Threads

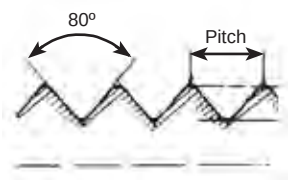
Thread Size	M6	M8	M10	M12	M16	M20	M25	M32	M40	M50	M63
Major Dia. in Inches (mm)	.24 (6)	.31 (8)	.39 (10)	.47 (12)	.63 (16)	.79 (20)	.98 (25)	1.26 (32)	1.57 (40)	1.97 (50)	2.48 (63)
Pitch in Inches (mm)	.04 (1)	.05 (1.25)	.06 (1.5)	.06 (1.5)	.06 (1.5)	.06 (1.5)	.06 (1.5)	.06 (1.5)	.06 (1.5)	.06 (1.5)	.06 (1.5)



- World-wide most commonly used type thread
- Characterized by its major diameter and its pitch
- Designated by the letter M followed by the value of the nominal diameter and the pitch, both expressed in millimeters and separated by the multiplication sign '×' (i.e. M12 x 1.5)

PG Threads

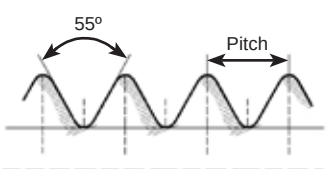
Thread Size	PG 7	PG 9	PG 11	PG 13.5	PG 16	PG 21	PG 29	PG 36	PG 42	PG 48
Major Dia. in Inches (mm)	.49 (12.5)	.60 (15.2)	.73 (18.6)	.80 (20.4)	.89 (22.5)	1.11 (28.3)	1.46 (37)	1.85 (47)	2.13 (54)	2.39 (59.3)
Pitch in Inches (mm)	.05 (1.27)	.055 (1.41)	.055 (1.51)	.055 (1.51)	.055 (1.51)	.062 (1.59)	.062 (1.59)	.062 (1.59)	.062 (1.59)	.062 (1.59)



- PG Thread = Panzer-Gewinde (also Panzer-Rohr-Gewinde)
- German thread type
- Depth of thread smaller than NPT or Metric, but larger flank angle

BSPP Threads

Thread Size	2-1/2"	3"	4"
Major Dia. in Inches (mm)	2.96 (75.84)	3.46 (87.88)	4.45 (113.03)
Pitch in Inches (mm)	.09 (2.31)	.09 (2.31)	.09 (2.31)
Threads per Inch	11	11	11



- BSPP Thread = British Standard Pipe Parallel Thread
- Parallel (straight) thread with a constant diameter, denoted by the letter G
- Symmetrical V-thread in which the angle between the flanks is 55° (measured in an axial plane)
- One-sixth of this sharp V is truncated at the top and the bottom
- Threads are rounded equally at crests and roots by circular arcs ending tangentially with the flanks
- The theoretical depth of the thread is therefore 0.64 times the nominal pitch