

Valvetop™ DXN with Nuclear GO™ Switches

Installation, Operation & Maintenance Manual



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Installation on Actuator

Orientations, Normal and Reverse Acting

Normal acting is full CW when the process valve is closed and CCW when the process valve is open. *Reverse acting* is full CW when the process valve is open and CCW when the process valve is closed.

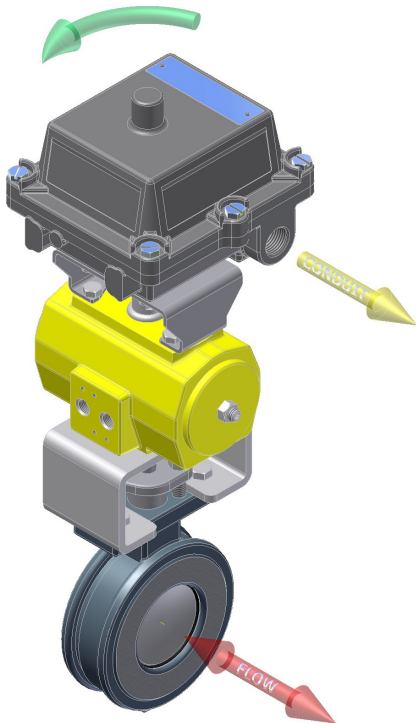
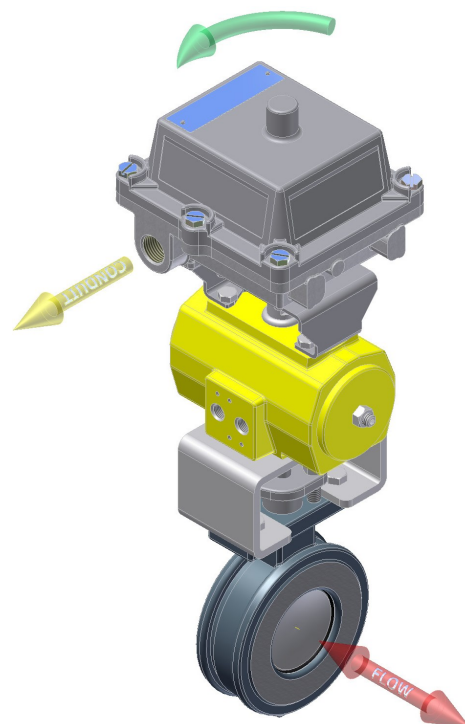


Illustration #1

The image to the left shows a Valvetop unit mounted parallel to the process valve in the closed position. The green arrow at the top shows the “normal acting” direction of travel to open the valve. This is the standard orientation and your unit unless otherwise specified will be factory set to operate in this fashion.

Illustration #2

The image to the right shows a Valvetop mounted perpendicular to the process valve in the closed position. The green arrow at the top shows the “normal acting” direction of travel to open the valve. Notice that the indicator dome has been rotated 90° compared to the unit above.

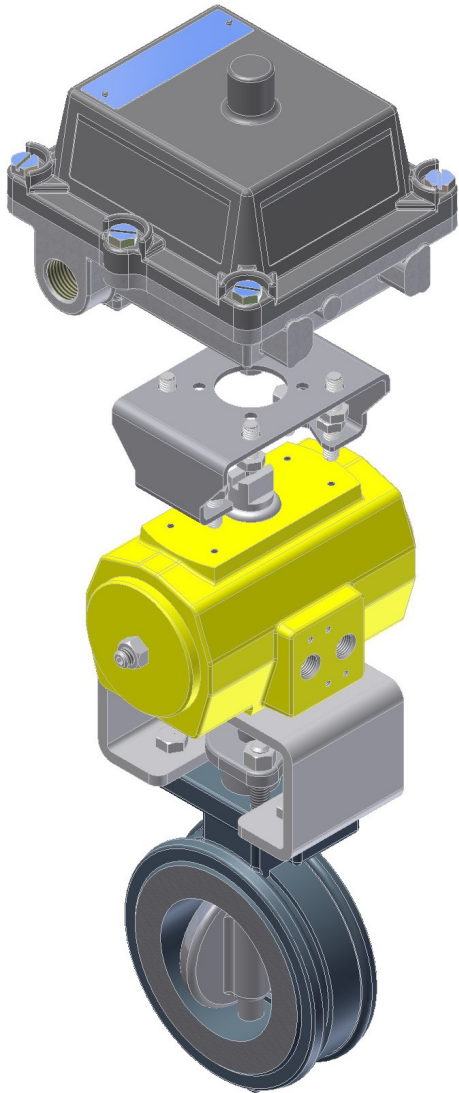


Installation on Actuator *(continued)*



Mounting

TopWorx has numerous mounting bracket kits available to meet your specific application, whether rotary or linear. Consult your local distributor or factory representative for ordering information. The illustration shows a direct Namur mount on a quarter turn valve. Refer to your mounting kit documentation for specific mounting instructions.

Illustration #3: Mounting Assembly

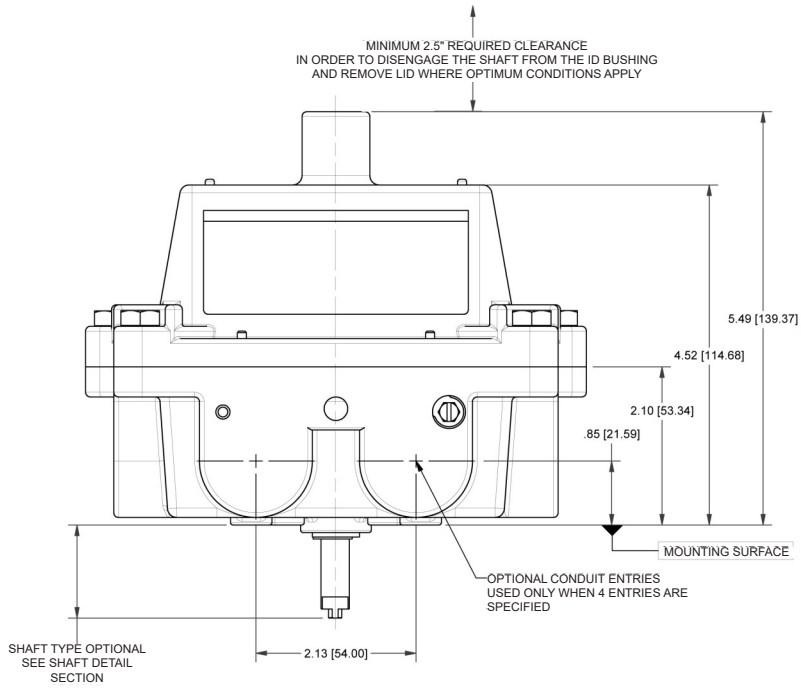


Installation Notes

1. Use caution not to allow undue axial (thrust) load on the shaft.
2. Cycle the valve a couple of times prior to final tightening of the mounting kit hardware. This allows the shaft to self-center in the pinion slot, or coupler. Refer to the dimensions and materials section of this document for appropriate tightening torque.
3. Always use sound mechanical practices when torquing down any hardware or making pneumatic connections. Refer to the Integrated Pneumatic Control Valves section for detailed information on pneumatic connections.
4. This product comes shipped with conduit covers in the conduit entries in an effort to protect the internal components from debris during shipment and handling. **It is the responsibility of the receiving and/or installing personnel to provide appropriate permanent sealing devices to prevent the intrusion of debris, or moisture, when stored outdoors or when installed.** 
5. **It is the responsibility of the installer, or end user, to install this product in accordance with the National Electrical Code (NFPA 70) or any other national or regional code defining proper practices.** 

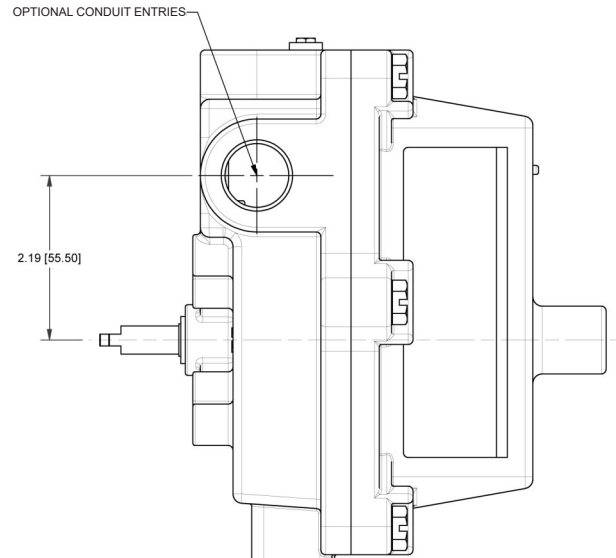
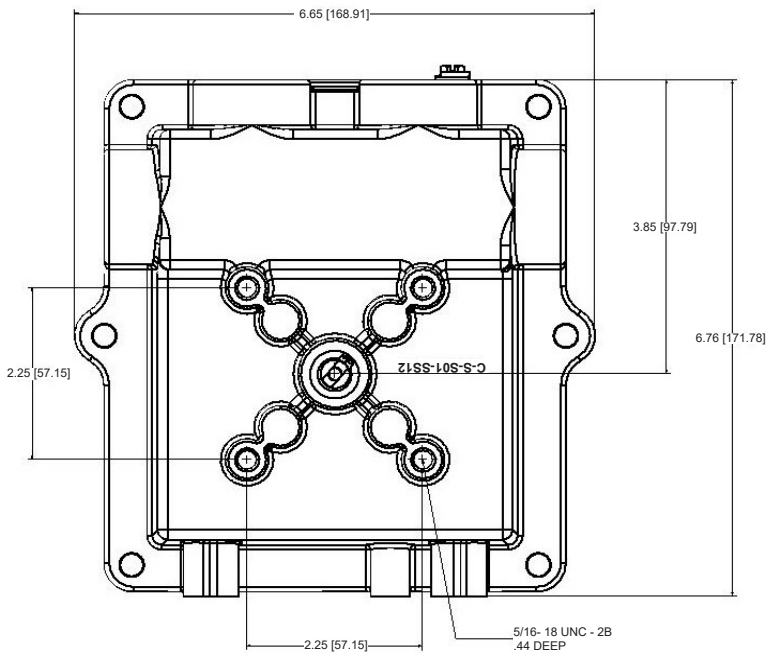
Dimensions and Materials: Valvetop DXN

Illustration #4: DXN Dimensional Drawing



MATERIALS OF CONSTRUCTION	
Enclosure	Cast 316 Stainless Steel
Fasteners	304 Stainless Steel standard & 316 Stainless Steel
Shaft	304 Stainless Steel standard & 316 Stainless Steel
Shaft Bushing	N/A
Seals	Silicone O-Rings

Maximum Fastener Torque Specifications	
Enclosure Housing Bolts	20 ft-lbs [27.1 N·m]
Bottom Mounting Holes	10 ft-lbs [13.6 N·m]



Dimensions and Materials: Enclosure and Shafts

Illustration #5: Enclosure Assembly

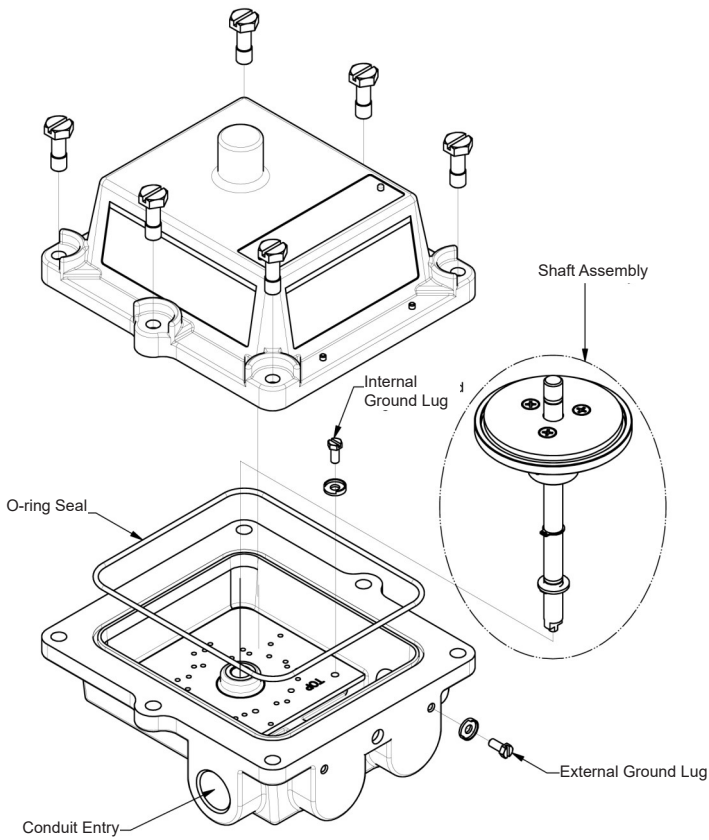
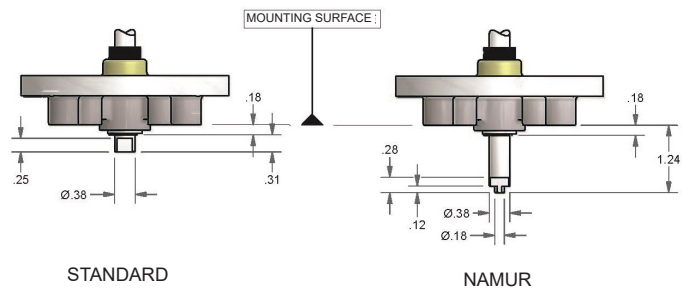


Illustration #6: Shaft Detail



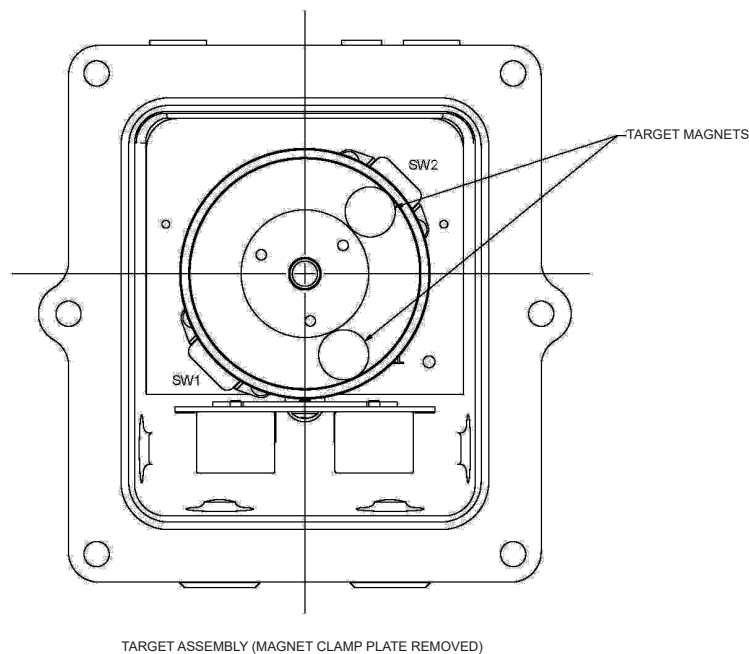
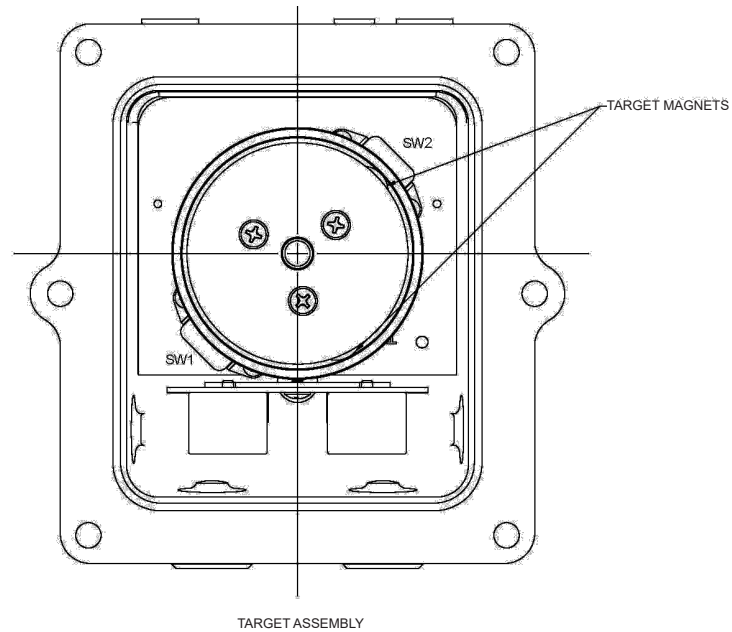
Switch Orientation

All Valvetop products are factory set for 90° rotation normal acting on parallel orientation with switch 1 (full clockwise) for the process valve closed position

When changing orientation the target magnets will have to be relocated for your application. Target magnets are infinitely adjustable, allowing the Valvetop unit to be rotated 90°, 180°, or 270° from standard.

Illustration #7: Typical L2 Target Arrangement

MINIMUM USABLE ROTATION 45°
MAXIMUM USABLE ROTATION 125°



Switch Calibration Procedure

Never perform switch calibration procedure while area is known to be hazardous.

For target adjustment of DXN models mounted in parallel and perpendicular orientation

Step 1: Remove 3 Phillips head screws and magnet clamp plate and target magnets.

Step 2: With the valve CLOSED position, slide target magnet#1 over switch 1 so that it activates. Ensure the magnet is seated against target hub and o-ring.

Step 3: Rotate the valve to the OPEN position, slide target magnet#2 over switch 2 so that it activates. Ensure the magnet is seated against target hub and o-ring.

Step 4: Place magnet clamp plate onto target hub aligning the three holes. Attach clamp plate with 3 Phillips head screws. Torque screws to 160 in-oz minimum.

Step 5: Cycle the valve CLOSED and OPEN several times to ensure proper calibration. If recalibration is required repeat steps 1 through 4.

For reverse acting applications (CCW to close), the switch functions will be transposed. Sw 1 becomes open. Sw 2 becomes closed.

The target disk has been designed to accommodate various applications and rotations. If your application is different from those outlined here, please consult the factory for further information.

Terms and Definitions

Process valve: A valve that is being controlled either by actuator or cylinder and the use of a Valvetop product with or without a control valve.

Control valve: A valve used to power an actuator or cylinder that is in turn used to actuate a process valve.

Clockwise (CW): Rotated in the direction of a clocks normal movement.

Counter clockwise (CCW): Rotated in the opposite direction of a clocks normal movement.

Normal acting: Full CW is when the process valve is closed and CCW is when the process valve is open.

Reverse acting: Full CW is when the process valve is open and CCW is when the process valve is closed

Parallel orientation: Process valve flow is parallel to the direction of the side conduit entries of the enclosure

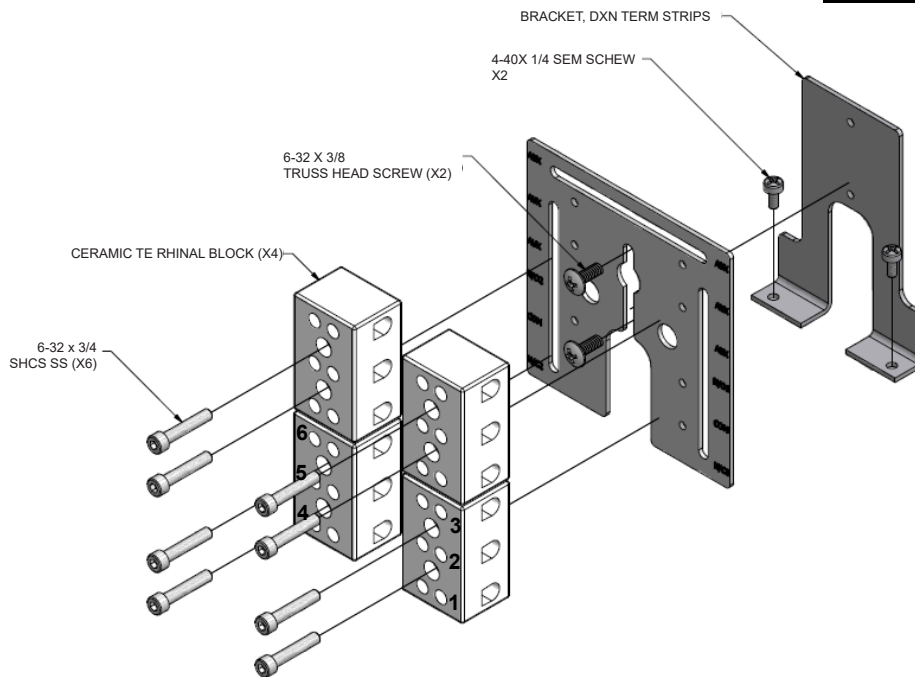
Perpendicular orientation: Process valve flow is perpendicular to the direction of the side conduit entries of the enclosure.

GO Switch Replacement Part	
35N	SPDT 35 Series Nuclear GO Switch

Wiring & Safe Use

Illustration #8: Terminal Strip Assembly

Switch 1	
Green to GND	Ground
COM (Black)	Terminal 2
NC (Red)	Terminal 1
NO (Blue)	Terminal 3
Switch 2	
Green to GND	Ground
COM (Black)	Terminal 5
NC (Red)	Terminal 4
NO (Blue)	Terminal 6



Special Conditions of Safe Use (All installations)

Clean only with a damp cloth to prevent possibility of electrostatic discharge.

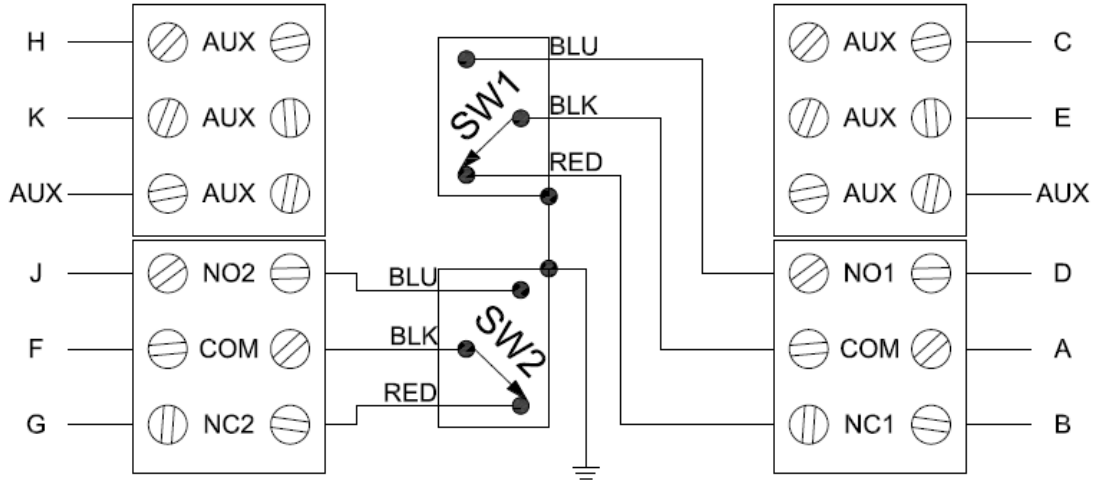
When installing with a third party listed nipple-mount solenoid, it is the responsibility of the installer to provide fittings, and apparatus, suitable for the area classification in accordance with the National Electrical Code.

Preventative Maintenance

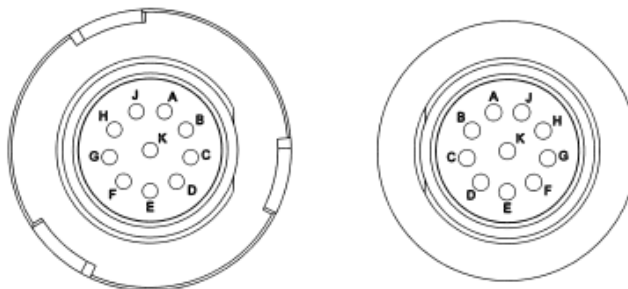
The TopWorx Valvetop is designed to operate for one million cycles without servicing. Please contact TopWorx when you are approaching this milestone for a preventative maintenance kit and instructions.

Wiring & Safe Use

Illustration #9: EGS Connector Wiring



EGS Connector Termination		
Terminal	Wire Marker	Wire Color
COM	A	WHITE
NC1	B	RED
AUX	C	GREEN
NO1	D	ORANGE
AUX	E	BLUE
COM	F	WHITE W/ BLACK
NC2	G	RED W/ BLACK
AUX	H	GREEN W/ BLACK
NO2	J	ORANGE W/ BLACK
AUX	K	BLACK



IEEE (Containment)

Technical Data

- Two GO™ Switches to give Open/Close indication
- Single Pole Double Throw contacts (SPDT Form C)
- 106 Years Qualified Life @ 48.9°C (120°F)
- Hermetically Sealed
- Maximum Temperature 257°C (495°F) LOCA Peak
- Maximum Total Exposed Radiation: 235.4 Mrad
- RIM Testing: 10g ZPA
- 316 Stainless Steel Housing:
 - Ceramic terminal block for quick & easy wiring
- Weight: Approximately 17 lbs.

Certificate of Compliance: Available for each part number

OPERATING TEMPERATURES

DXN Switchbox	
Qualified Life (Years)	Max. Normal Op. Temp.*
5	76°C
10	69°C
20	63°C
40	57°C
60	52.5°C

*Switch qualified life depends on operating temperature. (Please consult TopWorx™ for any operating temperature exceeding those listed above.)

Contact Electrical Ratings

TopWorx™ is aware that different field applications may require various amperage and voltage ratings. In all applications, users must observe all three guidelines on power, voltage and current values (listed below):

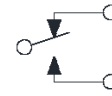
Contact Ratings* (Resistive)	AC	DC
Power (W)	0.5 - 480	0.2 - 72
Voltage (V)	100 - 250	24 - 137
Current (A)	0.004 - 5.0	0.004 - 3.0

*Please consult TopWorx™ when planning to operate switches with an inductive load.

TopWorx™ Nuclear DXN

Enclosure	Bus/Sensor	Area Classification	Visual Display	Shaft	Conduit Entries	O-Rings	Termination
DXN 316L Stainless Steel Discrete Valve Controller	LN 2 Nuclear GO Switches, SPDT with Hermetic Seal	Q Containment Z Harsh P Mild	D No Indicator	N Namur 304 Stainless Steel S 1/4" DD 304 Stainless Steel	E (2) 3/4" NPT M (2) M20 3 (4) M20 4 (2) 3/4" (2) 1/2" NPT 6 (4) 3/4" NPT N (4) 3/4" NPT w/ EGS GEN 3 Disconnect & Matching Cable & (2) 3/4" NPT plugs	S Silicone	Peek Cable _3 72" _4 144" _20 20' --- Available with N Conduit Entry only Greater than 144" specify length in 5ft increments
Ordering Guide Fill in the boxes to create your 'ordering number'!							
Enclosure DXN	Bus/Sensor LN	Area Classification _____	Visual Display D	Shaft _____	Conduit Entries _____	O-Rings S	Termination _____

DXN
Containment



SPDT FORM C

IEEE (Containment)



Maintenance:
None required during qualified life

Test Sequence Completed	Specifications	Levels Achieved
Thermal Cycling	<ul style="list-style-type: none"> IEEE-572-2006/1985 	<ul style="list-style-type: none"> Thirty 10°C (50°F) to 122°C (251.6°F) to 10°C (50°F) cycles
Thermal Aging	<ul style="list-style-type: none"> ANSI/IEEE Std. 323-2003/1983/1974 	<ul style="list-style-type: none"> > 106-year normal service life
Normal Pressurization Cycling	<ul style="list-style-type: none"> IEEE-382-2006/1996 	<ul style="list-style-type: none"> 17 external pressure cycles at 75psig
Normal Radiation	<ul style="list-style-type: none"> ANSI/IEEE Std. 323-2003/1983/1974 	<ul style="list-style-type: none"> Total Dose of 44.1 - 47.4 Mrads Dose Rate < 1 Mrad/hr.
Cycle Aging	<ul style="list-style-type: none"> Per specific customer 	<ul style="list-style-type: none"> 20,000 cycles 48V and 1A
Vibration Aging	<ul style="list-style-type: none"> IEEE-344-2013/2006/1987/1975 	<ul style="list-style-type: none"> 3 Orthogonal Axes 5-100-5Hz 0.75g 1 octaves/min, in each axis
Sine Sweep OBE (Low Fatigue Cycle Test)		<ul style="list-style-type: none"> 3 Orthogonal Axes 1 sweep, 2-64-2 Hz 6.67g min (at >10.08 HZ)
Sine Beat SSE		<ul style="list-style-type: none"> 3 Orthogonal Axes 1/3 octave from 2-32 Hz 1/6 octave from 32-64 Hz 12 oscillation/beat Min: 6.60g ZPA Max: 14.5g ZPA (at >10.08 Hz) Maximum 100g SRS Response at 5% damping
OBE RMF Tri-axial		<ul style="list-style-type: none"> 30 sec RMF Triaxial OBE level
SSE RMF Tri-axial		<ul style="list-style-type: none"> 30 sec RMF Triaxial SSE level
Accident Radiation	<ul style="list-style-type: none"> ANSI/IEEE Std. 323-2003/1983/1974 	<ul style="list-style-type: none"> Total Dose of 176.4 - 188.0 Mrads Dose Rate ≤ 1Mrad/hr
LOCA and Post LOCA Accident Simulation	<ul style="list-style-type: none"> IEEE-382-2006/1996 	<ul style="list-style-type: none"> LOCA Profile 495°F peak temperature, ~max 90psig pressure, with chemical spray 30 days accelerated (1 year equivalent) post LOCA with chemical spray

IEEE (Harsh)

Technical Data

- Two GO™ Switches to give Open/Close indication
- Single Pole Double Throw contacts (SPDT Form C)
- 106 Years Qualified Life @ 48.9°C (120°F)
- Hermetically Sealed
- Maximum Total Exposed Radiation: 235.4 Mrad
- RIM Testing: 10g ZPA
- 316 Stainless Steel Housing:
 - Ceramic terminal block for quick & easy wiring
- Weight: Approximately 17 lbs.

OPERATING TEMPERATURES

DXN Switchbox	
Qualified Life (Years)	Max. Normal Op. Temp.*
5	76°C
10	69°C
20	63°C
40	57°C
60	52.5°C

*Switch qualified life depends on operating temperature. (Please consult TopWorx™ for any operating temperature exceeding those listed above.)

Certificate of Compliance: Available for each part number

Contact Electrical Ratings

TopWorx™ is aware that different field applications may require various amperage and voltage ratings. In all applications, users must observe all three guidelines on power, voltage and current values (listed below):

Contact Ratings* (Resistive)	AC	DC
Power (W)	0.5 - 480	0.2 - 72
Voltage (V)	100 - 250	24 - 137
Current (A)	0.004 - 5.0	0.004 - 3.0

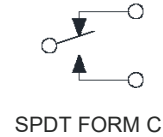
*Please consult TopWorx™ when planning to operate switches with an inductive load.

TopWorx™ Nuclear DXN

Enclosure	Bus/Sensor	Area Classification	Visual Display	Shaft	Conduit Entries	O-Rings	Termination
DXN 316L Stainless Steel Discrete Valve Controller	LN 2 Nuclear GO Switches, SPDT with Hermetic Seal	Q Containment Z Harsh P Mild	D No Indicator	N Namur 304 Stainless Steel S 1/4" DD 304 Stainless Steel	E (2) 3/4" NPT M (2) M20 3 (4) M20 4 (2) 3/4" (2) 1/2" NPT 6 (4) 3/4" NPT N (4) 3/4" NPT w/ EGS GEN 3 Disconnect & Matching Cable & (2) 3/4" NPT plugs	S Silicone	Peek Cable _3 72" _4 144" _20 20' --- Available with N Conduit Entry only Greater than 144" specify length in 5ft. increments
Ordering Guide Fill in the boxes to create your ordering number!							
Enclosure DXN	Bus/Sensor LN	Area Classification _____	Visual Display D	Shaft _____	Conduit Entries _____	O-Rings S	Termination _____

DXN
Harsh

IEEE (Harsh)



Maintenance:
None required during qualified life

Test Sequence Completed	Specifications	Levels Achieved
Thermal Cycling	<ul style="list-style-type: none"> IEEE-572-2006/1985 	<ul style="list-style-type: none"> Thirty 10°C (50°F) to 122°C (251.6°F) to 10°C (50°F) cycles
Thermal Aging	<ul style="list-style-type: none"> ANSI/IEEE Std. 323-2003/1983/1974 	<ul style="list-style-type: none"> > 106-year normal service life
Normal Radiation	<ul style="list-style-type: none"> ANSI/IEEE Std. 323-2003/1983/1974 	<ul style="list-style-type: none"> Total Dose of 44.1 - 47.4 Mrads Dose Rate < 1 Mrad/hr.
Cycle Aging	<ul style="list-style-type: none"> Per specific customer 	<ul style="list-style-type: none"> 20,000 cycles 48V and 1A
Vibration Aging	<ul style="list-style-type: none"> IEEE-344-2013/2006/1987/1975 	<ul style="list-style-type: none"> 3 Orthogonal Axes 5-100-5Hz 0.75g 1 octaves/min, in each axis
Sine Sweep OBE (Low Fatigue Cycle Test)		<ul style="list-style-type: none"> 3 Orthogonal Axes 1 sweep, 2-64-2 Hz 6.67g min (at > 10.08 HZ)
Sine Beat SSE		<ul style="list-style-type: none"> 3 Orthogonal Axes 1/3 octave from 2-32 Hz 1/6 octave from 32-64 Hz 12 oscillation/beat Min: 6.60g ZPA Max: 14.5g ZPA (at > 10.08 Hz) Maximum 100g SRS Response at 5% damping
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Accident Radiation	<ul style="list-style-type: none"> ANSI/IEEE Std. 323-2003/1983/1974 	<ul style="list-style-type: none"> Total Dose of 176.4 - 188.0 Mrads Dose Rate ≤ 1Mrad/hr

IEEE (Mild)

Technical Data

- Two GO™ Switches to give Open/Close indication
- Single Pole Double Throw contacts (SPDT Form C)
- 106 Years Qualified Life @ 48.9°C (120°F)
- Hermetically Sealed
- Normal Radiation: 47.4 Mrad
- RIM Testing: 10g ZPA
- 316 Stainless Steel Housing:
 - Ceramic terminal block for quick & easy wiring
- Weight: Approximately 17 lbs.

OPERATING TEMPERATURES

DXN Switchbox	
Qualified Life (Years)	Max. Normal Op. Temp.*
5	76°C
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*Switch qualified life depends on operating temperature. (Please consult TopWorx™ for any operating temperature exceeding those listed above.)

Certificate of Compliance: Available for each part number

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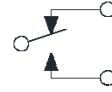
Contact Ratings* (Resistive)	AC	DC
Power (W)	0.5 - 480	0.2 - 72
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Current (A)	0.004 - 5.0	0.004 - 3.0

*Please consult TopWorx™ when planning to operate switches with an inductive load.

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Ordering Guide Fill in the boxes to create your ordering number:¹							
Enclosure DXN	Bus/Sensor LN	Area Classification _____	Visual Display D	Shaft _____	Conduit Entries _____	O-Rings S	Termination _____

DXN
Mild



SPDT FORM C

IEEE (Mild)



Maintenance:
None required during qualified life

Test Sequence Completed	Specifications	Levels Achieved
Thermal Cycling	<ul style="list-style-type: none"> • IEEE-572-2006/1985 	<ul style="list-style-type: none"> • Thirty 10°C (50°F) to 122°C (251.6°F) to 10°C (50°F) cycles
Thermal Aging	<ul style="list-style-type: none"> • ANSI/IEEE Std. 323-2003/1983/1974 	<ul style="list-style-type: none"> • > 106-year normal service life
Normal Radiation	<ul style="list-style-type: none"> • ANSI/IEEE Std. 323-2003/1983/1974 	<ul style="list-style-type: none"> • Total Dose of 44.1 - 47.4 Mrads • Dose Rate < 1 Mrad/hr.
Cycle Aging	<ul style="list-style-type: none"> • Per specific customer 	<ul style="list-style-type: none"> • 20,000 cycles • 48V and 1A
Vibration Aging	<ul style="list-style-type: none"> • IEEE-344-2013/2006/1987/1975 	<ul style="list-style-type: none"> • 3 Orthogonal Axes • 5-100-5Hz • 0.75g • 1 octaves/min, in each axis
Sine Sweep OBE (Low Fatigue Cycle Test)		<ul style="list-style-type: none"> • 3 Orthogonal Axes • 1 sweep, 2-64-2 Hz • 6.67g min (at > 10.08 HZ)
Sine Beat SSE		<ul style="list-style-type: none"> • 3 Orthogonal Axes • 1/3 octave from 2-32 Hz • 1/6 octave from 32-64 Hz • 12 oscillation/beat • Min: 6.60g ZPA • Max: 14.5g ZPA (at >10.08 Hz) • Maximum 100g SRS Response at 5% damping
OBE RMF Tri-axial		<ul style="list-style-type: none"> • 30 sec RMF Triaxial OBE level
SSE RMF Tri-axial	<ul style="list-style-type: none"> • 30 sec RMF Triaxial SSE level 	

Standards

AECL 98-30830-TS 008

AECL 98-60000-TS 005

AECL 98-60000-TS 006

IEEE 382-1996/2006

IEEE 572-1985

IEEE 344-1975/1987/2004

IEEE 323-1974/1983/2003

Qualification Test Reports: On Request

Warranty

TOPWORX TERMS AND CONDITIONS OF SALE

These terms and conditions, the attendant quotation or acknowledgment, and all documents incorporated by reference therein, binds TopWorx, Inc. hereinafter the Seller, and the buyer, hereinafter Buyer, and constitutes the entire agreement (Agreement) between Buyer and Seller for the provision of services (Services) and/or the sale of goods (Goods) including (except as provided in Section 10) firmware incorporated therein.

1. PRICES: Unless otherwise specified by Seller, Seller's price for the Goods and/or Services shall remain in effect for thirty (30) days after the date of Seller's quotation or acceptance of the order for the Goods/Services, whichever is delivered first, provided an unconditional, complete authorization for the immediate manufacture and shipment of the Goods and/or provision of Services pursuant to Seller's standard order processing procedures is received and accepted by Seller within such time period. If such authorization is not received by Seller within such thirty (30) day period, Seller shall have the right to change the price for the Goods/Services to Seller's price in effect for the Goods/Services at the time the order is released to final manufacture. Prices for Goods do not cover storing, installing, starting up or maintaining Goods unless expressly stated in Seller's quotation. Notwithstanding the foregoing, the price for Goods/Services sold by Seller, but manufactured by others, shall be Seller's price in effect at the time of shipment to Buyer.

2. DELIVERY, ORDER ACCEPTANCE AND DOCUMENTATION: All shipping dates are approximate and are based upon Seller's prompt receipt of all necessary information from Buyer to properly process the order. Notwithstanding any provisions to the contrary in this or other documents related to this transaction, and regardless of how price was quoted, whether FOB, FAS, CIF or otherwise, legal title to the Goods and risk of loss thereto shall transfer to Buyer as follows: for sales in which the end destination of the Goods is within the United States, upon delivery to the freight carrier at the shipping point; for sales in which the end destination of the Goods is outside of the United States, immediately after the Goods have passed beyond the territorial limits of the United States. Seller shall provide Buyer with that data/documentation which is specifically identified in the quotation. If additional copies of data/documentation or non-standard data/documentation are to be provided by Seller, they shall be provided to Buyer at Seller's price then in effect. Data/documentation marked as confidential or proprietary may not be reproduced or used for any purpose other than the purpose for which it was provided and may not be disclosed to third parties without the prior written permission of Seller.

3. EXCUSE OF PERFORMANCE: Seller shall not be liable for delays in performance or for non-performance due to failure or interruption of computer or telecommunication systems, acts of God, war, riot, fire, terrorism, labor trouble, unavailability of materials or components, explosion, accident, compliance with governmental requests, laws, regulations, orders or actions, or other unforeseen circumstances or causes beyond Seller's reasonable control. In the event of such delay, the time for performance or delivery shall be extended by a period of time reasonably necessary to overcome the effect of the delay.

4. TERMINATION AND SUSPENSION BY BUYER: Buyer may terminate or suspend its order for any or all of the Goods/Services covered by the Agreement provided that Buyer gives Seller reasonable advance written notice of such termination or suspension and reimburses Seller for all losses, damages, costs and expenses arising from such termination or suspension.

5. LIMITED WARRANTY: Subject to the limitations contained in Section 6 herein, Seller warrants that the licensed firmware embodied in the Goods will execute the programming instructions provided by Seller, and that the Goods manufactured or Services provided by Seller will be free from defects in materials or workmanship under normal use and care. The foregoing warranties will apply until the expiration of the applicable warranty period. All other Goods are warranted for twelve (12) months from the date of shipment by Seller. Consumables and Services are warranted for a period of 90 days from the date of shipment or completion of the Services. Products purchased by Seller from a third party for resale to Buyer ("Resale Products") shall carry only the warranty extended by the original manufacturer. Buyer agrees that Seller has no liability for Resale Products beyond making a reasonable commercial effort to arrange for procurement and shipping of the Resale Products. If Buyer discovers any warranty defects and notifies Seller thereof in writing during the applicable warranty period, Seller shall, at its option, correct any errors that are found by Seller in the firmware or Services or repair or replace F.O.B. point of manufacture that portion of the Goods or firmware found by Seller to be defective, or refund the purchase price of the defective portion of the Goods/Services. All replacements or repairs necessitated by inadequate maintenance, normal wear and usage, unsuitable power sources or environmental conditions, accident, misuse, improper installation, modification, repair, use of unauthorized replacement parts, storage or handling, or any other cause not the fault of Seller are not covered by this limited warranty, and shall be at Buyer's expense. Seller shall not be obligated to pay any costs or charges incurred by Buyer or any other party except as may be agreed upon in writing in advance by Seller. All costs of dismantling, reinstallation and freight and the time and expenses of Seller's personnel and representatives for site travel and diagnosis under this warranty clause shall be borne by Buyer unless accepted in writing by Seller. Goods repaired and parts replaced by Seller during the warranty period shall be in warranty for the remainder of the original warranty period or ninety (90) days, whichever is longer. This limited warranty is the only warranty made by Seller and can be amended only in a writing signed by Seller. THE WARRANTIES AND REMEDIES SET FORTH ABOVE ARE EXCLUSIVE. THERE ARE NO REPRESENTATIONS OR WARRANTIES OF ANY KIND, EXPRESS OR IMPLIED, AS TO MERCHANTABILITY, FITNESS FOR PARTICULAR PURPOSE OR ANY OTHER MATTER WITH RESPECT TO ANY OF THE GOODS OR SERVICES.

6. LIMITATION OF REMEDY AND LIABILITY: SELLER SHALL NOT BE LIABLE FOR DAMAGES CAUSED BY DELAY IN PERFORMANCE. THE REMEDIES OF BUYER SET FORTH IN THIS AGREEMENT ARE EXCLUSIVE. IN NO EVENT, REGARDLESS OF THE FORM OF THE CLAIM OR CAUSE OF ACTION (WHETHER BASED IN CONTRACT, INFRINGEMENT, NEGLIGENCE, STRICT LIABILITY, OTHER TORT OR OTHERWISE), SHALL SELLER'S LIABILITY TO BUYER AND/OR ITS CUSTOMERS EXCEED THE PRICE TO BUYER OF THE SPECIFIC GOODS MANUFACTURED OR SERVICES PROVIDED BY SELLER GIVING RISE TO THE CLAIM OR CAUSE OF ACTION. BUYER AGREES THAT IN NO EVENT SHALL SELLER'S LIABILITY TO BUYER AND/OR ITS CUSTOMERS EXTEND TO INCLUDE INCIDENTAL, CONSEQUENTIAL OR PUNITIVE DAMAGES. THE TERM "CONSEQUENTIAL DAMAGES" SHALL INCLUDE, BUT NOT BE LIMITED TO, LOSS OF ANTICIPATED PROFITS, REVENUE OR USE AND COSTS INCURRED INCLUDING WITHOUT LIMITATION FOR CAPITAL, FUEL AND POWER, AND CLAIMS OF BUYER'S CUSTOMERS.

7. PATENTS: Subject to the limitations contained in Section 6, Seller shall defend any suits brought against Buyer based on a claim that use of the Goods manufactured by Seller

constitutes an infringement of a valid patent of the United States, and shall pay any damages awarded therein against Buyer, provided that Buyer: promptly notifies Seller in writing of the filing of such suit or the threat thereof; permits Seller to control completely the defense or compromise of such claim of infringement; and provides all reasonable assistance and cooperation requested by Seller for the defense of such suit. In the event that only the Goods manufactured by Seller are held to be infringing in such suit and their use is enjoined, Seller shall, at its sole option and expense, provide a commercially reasonable alternative, including, but not limited to, procuring for Buyer the right to continue using the Goods, replacing them with a non-infringing product or modifying them so they become non-infringing. Buyer agrees that Seller shall not be liable for infringement, and that Buyer shall fully indemnify Seller therefore, if infringement is based upon the use of Goods in connection with goods not manufactured by Seller or in a manner for which the Goods were not designed by the Seller or if the Goods were not designed by the Seller or if the Goods were designed by the Buyer or were modified by or for the Buyer in a manner to cause them to become infringing.

8. TAXES: Any tax or governmental charge payable by the Seller because of the manufacture, sale or delivery of the Goods, or provision of Services, may at Seller's option be added to the price herein specified. The foregoing shall not apply to taxes based upon Seller's net income.

9. TERMS OF PAYMENT: Subject to the approval of Seller's Credit Department, terms are F.O.B. shipping point, net 30 days from date of Seller's invoice in U.S. currency, except for applicable milestone payments covered below or export shipments for which Seller may require other arrangements. Freight charges may include shipping and handling charges, and Buyer shall pay all such charges. If any payment owed to Seller hereunder is not paid when due, it shall bear interest at a rate 1-1/2% per month interest from the date on which it is due until it is received and future shipments may be placed on hold. Seller shall have the right, among other remedies, either to terminate the Agreement or to suspend further deliveries under this and/or other agreements with Buyer in the event Buyer fails to make any payment hereunder when due. Buyer shall be liable for all expenses attendant to collection of past due amounts, including attorneys' fees. Unless otherwise provided in Seller's written quotation, periodic milestone payments shall be made by Buyer when the purchase price of this Agreement exceeds \$100,000. In such cases, invoices shall be issued by Seller and paid by Buyer based on the following milestones: Milestone 1: 30% of price upon acceptance of order by Seller. Milestone 2: 30% of price upon release by Seller of approved bills of material to manufacturing for assembly. Milestone 3: 40% of price upon shipment of the Goods by Seller. Seller reserves the right to designate additional Milestones where the Agreement provides for Services in excess of \$50,000.

10. SOFTWARE AND FIRMWARE: Notwithstanding any other provision herein to the contrary, Seller or applicable third party owner shall retain all rights of ownership and title in its respective firmware and software, including all copyrights relating to such firmware and software and all copies of such firmware and software. Except as otherwise provided herein, Buyer is hereby granted a nonexclusive, royalty free license to use firmware and software, and copies of firmware and software, incorporated into the Goods only in conjunction with such Goods and only at the Buyer's plant site where the Goods are first used. Buyer may negotiate with Seller separate licenses to use such copies and firmware and software at other plant sites. Buyer's use of certain firmware (as specified by Seller) and all other software shall be governed exclusively by Seller's and/or third party owner's applicable license terms.

11. BUYER SUPPLIED DATA: To the extent that Seller has relied upon any specifications, information, representation of operating conditions or other data or information supplied by Buyer to Seller ("Data") in the selection or design of the Goods and/or provision of the Services and the preparation of Seller's quotation, and in the event that actual operating conditions or other conditions differ from those represented by Buyer and relied upon by Seller, any warranties or other provisions contained herein which are affected by such conditions shall be null and void.

12. EXPORT/IMPORT: Buyer agrees that all applicable import and export control laws, regulations, orders and requirements, including without limitation those of the United States and the European Union, and the jurisdictions in which the Seller and Buyer are established or from which items may be supplied will apply to its receipt and use of Goods and Services. In no event shall Buyer use, transfer, release, import, export, or re-export Goods in violation of such applicable laws, regulations, orders, or requirements.

13. GENERAL PROVISIONS: (a) Buyer shall not assign its rights or obligations under the Agreement without Seller's prior written consent; (b) there are no understandings, agreements or representations, express or implied, not specified in the Agreement; (c) no action, regardless of form, arising out of transactions under the Agreement, may be brought by either party more than two years after the cause of action has accrued; (d) any modification of these terms and conditions must be set forth in a written instrument signed by a duly authorized representative of Seller; (e) the Agreement is formed and shall be construed, performed and enforced under the laws of the State of Missouri (however, Buyer and Seller agree that the proper venue for all actions arising under the Agreement shall be only in the State where the Goods involved in such actions were manufactured; (f) The 1980 United Nations Convention on Contracts for the International Sale of Goods does not apply to this Agreement; (g) If any provision of the Agreement is invalid under any statute or rule of law, such provision, to that extent only, shall be deemed to be omitted without affecting the validity of the remainder of the Agreement; (h) Seller specifically objects to the application of any Federal Acquisition Regulation ("FAR") or other governmental procurement provision or clause to the Agreement; (i) UNLESS OTHERWISE SPECIFICALLY PROVIDED IN SELLER'S QUOTATION, GOODS AND SERVICES HEREUNDER ARE NOT INTENDED FOR USE IN ANY NUCLEAR OR NUCLEAR RELATED APPLICATIONS. Buyer (i) accepts Goods and Services in accordance with the restriction set forth in the immediately preceding sentence, (ii) agrees to communicate such restriction in writing to any and all subsequent purchasers or users and (iii) agrees to defend, indemnify and hold harmless Seller from any and all claims, losses, liabilities, suits, judgments and damages, including incidental and consequential damages, arising from use of Goods and Services in any nuclear or nuclear related applications, whether the cause of action be based in tort, contract or otherwise, including allegations that the Seller's liability is based on negligence or strict liability; (j) The rights, remedies and protections afforded to Seller under this Agreement, including but not limited to indemnification of Seller, limitation of remedy and liability and limited warranty shall extend to Seller and to its affiliates, subsidiaries, or related companies performing or supplying work, services, or products under this Agreement or any agreement into which it is incorporated by reference; and (k) Seller does not agree to: (i) indemnify Buyer; or (ii) name Buyer as an additional insured.

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