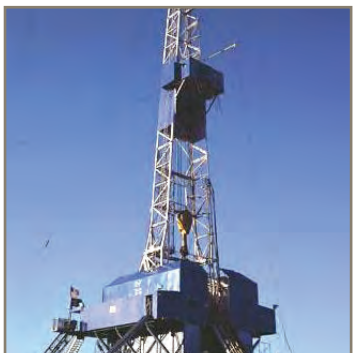




aerospace  
climate control  
electromechanical  
filtration  
fluid & gas handling  
hydraulics  
pneumatics  
process control  
sealing & shielding



# Parker Nitrogen Generation Systems

for the Oil and Gas Industry



ENGINEERING YOUR SUCCESS.

# Parker Hannifin Corporation

## The Global Leader in Motion and Control Technologies

We engineer success of our customers around the world, drawing upon nine core motion and control technologies. These technologies enable virtually every machine and process to operate accurately, efficiently and dependably.

As the global leader in motion and control, we partner with our distributors to increase our customers' productivity and profitability by delivering an unmatched breadth of engineered components and value-added services.

We continue to grow with our customers by creating application-focused products and system solutions. A key to our global expansion has been to follow our customers and establish operations, sales and service wherever they are needed. No single competitor matches Parker's global presence.



Corporate Headquarters  
in Cleveland, Ohio.

## Parker's Motion and Control Technologies

Aerospace	Hydraulics
Climate Control	Pneumatics
Electromechanical	Process Control
<b>Filtration</b>	Sealing & Shielding
Fluid & Gas Handling	

### Legal Notifications



**WARNING**

FAILURE OR IMPROPER SELECTION OR IMPROPER USE OF THE PRODUCTS AND/OR SYSTEMS DESCRIBED HEREIN OR RELATED ITEMS CAN CAUSE DEATH, PERSONAL INJURY AND PROPERTY DAMAGE.

This document and other information from Parker Hannifin Corporation, its subsidiaries and authorized distributors provide product and/or system options for further investigation by users having technical expertise. It is important that you analyze all aspects of your application and review the information concerning the product or system in the current product catalog. Due to the variety of operating conditions and applications for these products or systems, the user, through its own analysis and testing, is solely responsible for making the final selection of the products and systems and assuring that all performance, safety and warning requirements of the application are met.

The products described herein, including without limitation, product features, specifications, designs, availability and pricing, are subject to change by Parker Hannifin Corporation and its subsidiaries at any time without notice.

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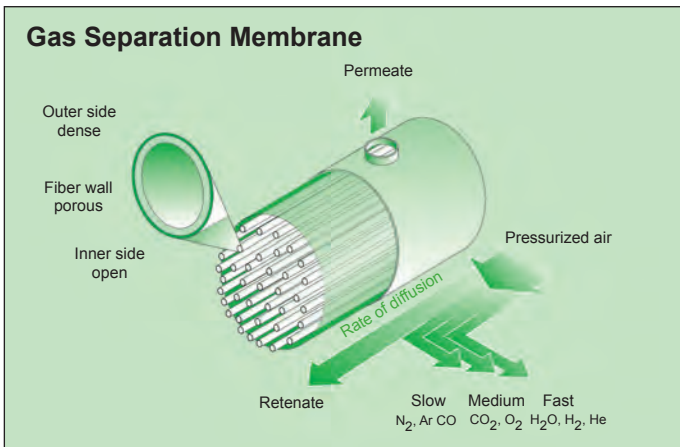
ENGINEERING YOUR SUCCESS.

# Nitrogen Membrane Technology

## How is Nitrogen Generated from the Parker Membranes?

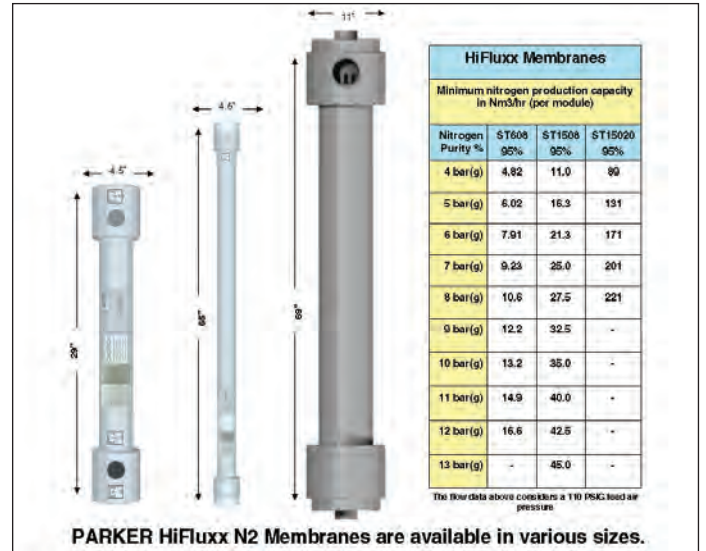
A reliable, high performance membrane module is the heart of a nitrogen gas generator. Customers around the world trust Parker Hannifin to provide reliable nitrogen gas generators that meet the specific needs of our customer applications.

Pressurized air is fed to one end of the hollow fiber membranes. The permeation rates of water vapor, CO<sub>2</sub>, and oxygen contained in the air stream are faster than nitrogen and argon and will rapidly diffuse through the fiber walls. The slower diffused nitrogen molecules remain in the fiber bore and are collected as the nitrogen product gas. The air flow rate will determine how much undiffused oxygen remains with the nitrogen gas. The nitrogen product gas is extremely dry, with atmospheric dew points typically below -40° F. The membranes act like a filter with no moving parts and continuously generate nitrogen at selected flow and purity.



Relative size of Hollow Fibers

High Performance Bundle



## Why are Parker HiFlux® Membranes Unique from other Membrane Filters?

Simply stated, Parker HiFlux® membranes are the most permeable membranes in the world! High permeability means more nitrogen is produced in each fiber.

### Benefits:

- Fewer membranes are required, resulting in lower membrane investment and smaller membrane footprints vs. competitive systems
- Excellent nitrogen production, even at low pressures, allows Parker membranes to operate directly from instrument or utility air systems or low pressure industrial compressors and still be compact and lightweight
- Low pressure compressors operate with less energy, less noise, and less maintenance
- Parker fibers are robust and are less sensitive to particle contamination than competitors
- No additional heating is required to improve membrane nitrogen production rates
- N<sub>2</sub> production is extremely stable over time with little or no performance degradation

# Pressure Swing Adsorption N2 Technology

## Why are Parker PSA Systems Superior to Competing Suppliers?

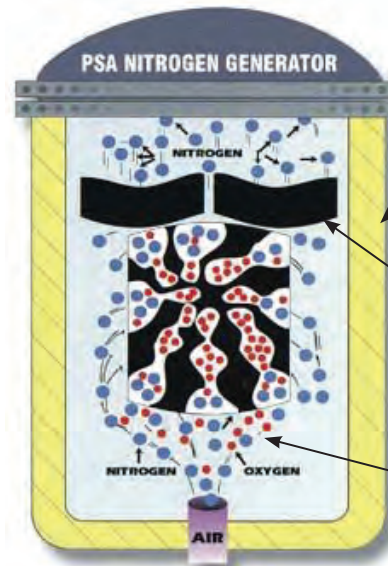
Parker's nitrogen gas generators separate nitrogen from air, utilizing pressure swing adsorption technology. Air entering the generator consists of 21% oxygen and 78% nitrogen. The gas separation process preferentially adsorbs oxygen over nitrogen using carbon molecular sieve (CMS), thus enabling the N2 to pass through as a product gas at pressure.

High performance and long bed life all start with good bed design, gas distribution and careful attention to air velocities and mechanical stresses on the carbon molecular sieves.

Both one and two bed units are specially charged with carbon molecular sieve (CMS). A solid state programmable controller simply operates the process valves on a cyclic basis, with built-in logic for automatic stop/start. Parker production and purity remain constant, regardless of the customer peak usage demands, by utilizing an automatic flow control valve. A continuous monitoring oxygen (O2) analyzer, with alarms and shutdown, is standard equipment.



All Parker systems include these key design elements:

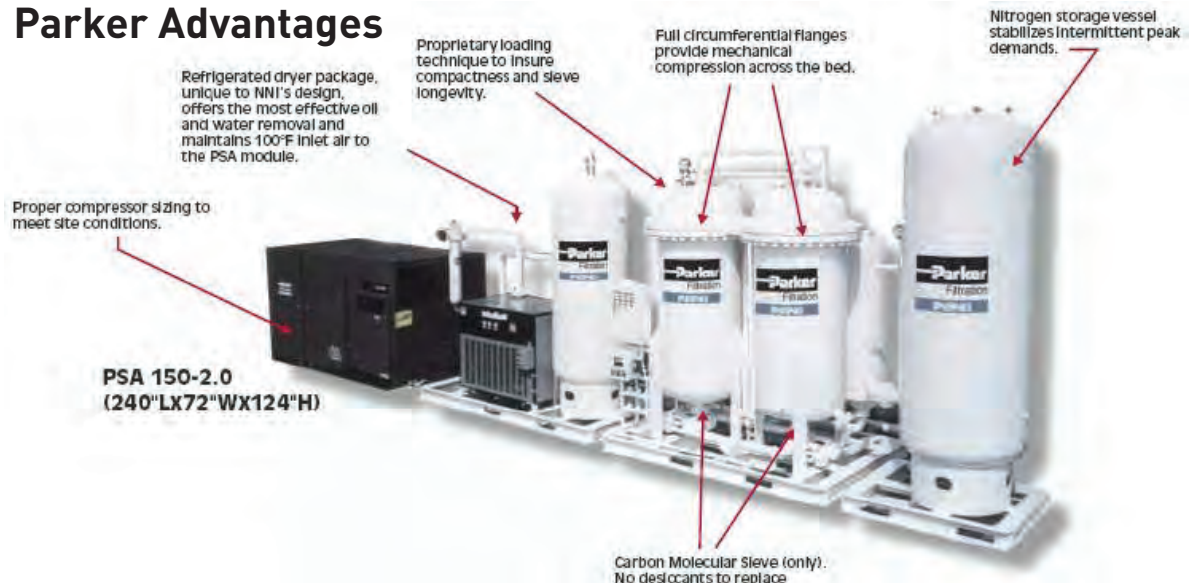


- Flanged Heads**  
which allow for proprietary CMS bed filling.
- Proper length/diameter**  
adsorbent vessel sizing to ensure low gas velocities during the normal nitrogen production cycle.
- Adsorbent beds**  
are mechanically pre-loaded under compression to buffer differential pressures during normal cycling.
- Gas velocity control**  
during high differential pressure cycles to eliminate fluidization of the CMS material.

### Features:

- High performance, high cycle switching valves for long, trouble-free operation
- Automatic alarm or shown down feature tied to high feed air dew points.
- Optional Energy Efficiency Control System to automatically reduce feed air requirements during periods of low nitrogen consumption (25 TO 30%)
- Easy leak-testing of valves, even during on-stream operation

## Parker Advantages



# Portable Nitrogen Membrane Systems

## Containerized Systems

All our products are engineered with the highest attention to detail. Parker provides the features you need and benefits you want. Parker nitrogen generators illustrate all aspects of engineering excellence.

Parker's HiFluxx® membranes are the ideal solution for large generators that must be compact and lightweight, such as trailer-mounted or containerized systems. All systems can be designed for low pressure feed air sources, giving the user the option of utilizing plant air or conventional single stage compressors. No other membrane system can offer the flexibility and feed air options for both onshore and offshore applications.



High flow 1500 scfm, 95% N2 system installed in a standard 20 ft ISO shipping container for operation in arctic conditions, ZONE II compliant.

### Applications:

- Underbalanced Drilling
- High Flow pipeline pigging/purging/inerting
- Pressure maintenance for depleted reservoirs
- Gas lift operations-onshore or offshore
- Work over applications with coiled tubing units
- LNG/chemical tanker systems
- Portable gas lift systems
- Offshore utility nitrogen

### Standard Container Capacities

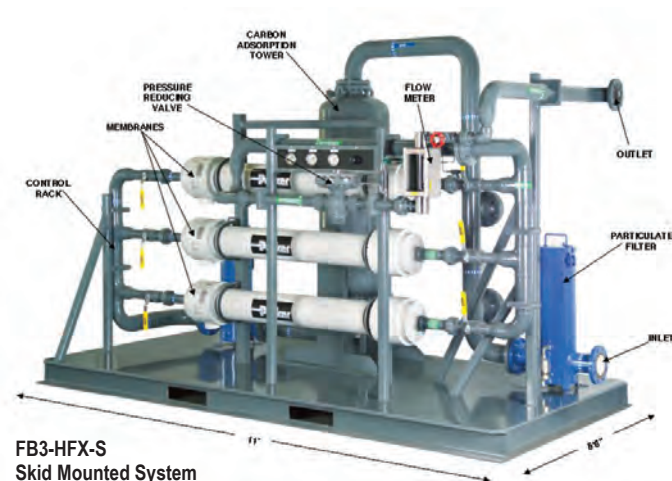
System operation at 116 psig inlet 95% N2 purity

Model	N2 Flow Rate (SCFM)	Weight (lbs.)
FB3-HFLX	400	7500
FB6-HFLX	800	8000
FB12-HFLX	1600	10,500
FB15-HFLX	2000	12,000

Note: Flow rates at standard conditions of 70°F at sea level.

## Skidded and Truck-Mounted Systems

Parker HiFluxx® membranes can be configured to fit any installation because of their inherent compactness and high N2 productivity.



FB3-HFX-S  
Skid Mounted System



Typical Coiled Tubing Rig for Well Workovers



Inerting of LNG and Chemical Ocean Transport Tankers

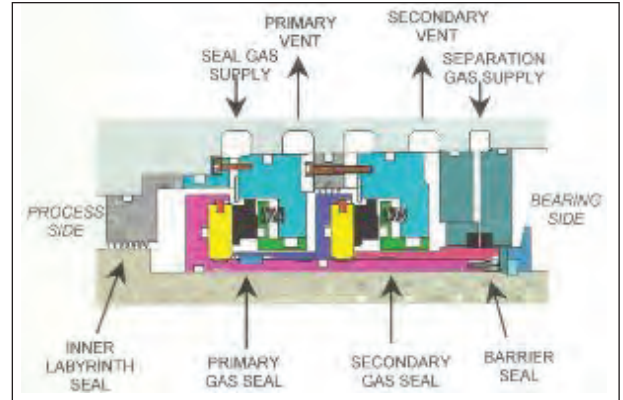
# Dry Gas Seal N2 Systems

## Standard Dry Gas Seal Systems



Model FB-608-1 with Membrane Dryer

Parker has developed a unique N2 generator for point-of-use applications that require a continuous supply of nitrogen where there is no electrical power supply or extremely hazardous conditions exist. These systems can also be equipped with Parker Balston membrane air dryer systems as well to treat high dew point or saturated feed air. All systems run automatically without operator attention.



A typical application is pressurizing dry gas seals on selected GAScompressor and turbine installations that need inert gas for lubricating and pressurizing dry seals designed to contain flammable, toxic, or hazardous process gases from leaking into the atmosphere.

	FB-608-1	FB-608-2	FB-1508-1	FB-1508-2	FB-1508-3	FB-1508-4
N2 Flow Rate (SCFM)	5	10	15	30	45	60

Note: Feed air pressure on all models is 110 psig, flow rates at standard conditions of 70°F at sea level.

## Custom Packaging Capabilities

All dry gas seal systems can be equipped with integral high pressure boosters as well as high-pressure cylinders. High pressure gas storage systems provide back-up N2 as needed, or provide periodic higher N2 flows if nitrogen consumption is erratic or cyclical. All system operation is automatic and unmanned. Fully automated, 100% redundant packages ensure that the customer is never without nitrogen.



Model FB-608-2  
Gas Seal Unit with  
Cylinder N2 Backup



Model  
SMD-FB-1508-4 Gas Seal Unit  
with Membrane Dryer



# High Pressure N2 Systems



**Nitrogen Gas Booster,**  
25 SCFM at 5,000 PSIG

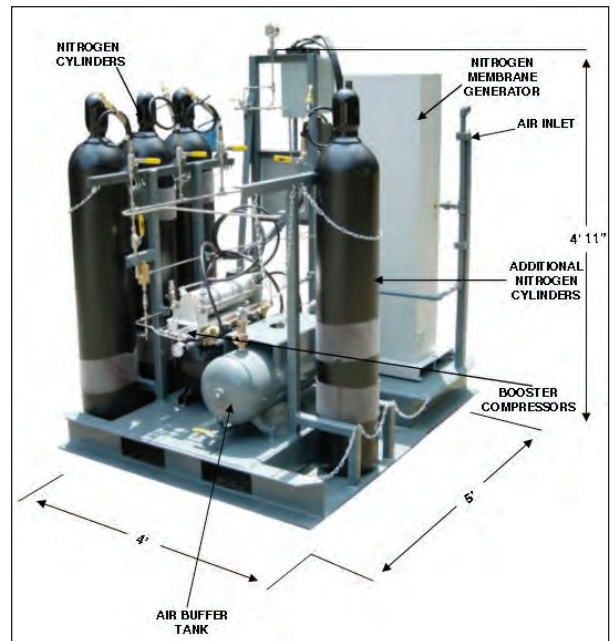
## Custom Compression Systems

Parker Hannifin has OEM relationships with the leading suppliers of feed air and booster compressors to supply N2 systems that meet virtually any high flow requirement to client specifications. Parker will work closely with our equipment partners to ensure customer specifications are met and global service is provided on a turnkey basis.

## Cylinder Filling Gas Boosters

Parker Hannifin offers a number of cost effective systems for generating high pressure N2 on site for delivery pressures up to 5,000 psig.

Typical applications include pressure-testing gas lines for deliver and piping systems, charging accumulators and gas cylinders, cleaning and pressure testing coiled tubing, and other N2 requirements in the field.



**Diesel Powered Nitrogen Gas Booster**  
• Capacity from 300 - 1,000 SCFM  
• Outlet pressures from 350 - 5,000 PSIG



**Diesel Powered Feed Air Compressor**  
• Typical 1,600 SCFM Unit at 145 PSIG to Parker Specifications

# Oil Field N2 PSA Systems

## Custom Designed PSA Systems

Parker's continuing in-house R&D has resulted in nitrogen generators that offer the best combination of economy and efficiency available today. With decades of experience in developing innovative products, Parker has set the standard for precision engineering, optimum performance, and customer satisfaction.

As nitrogen flow and purity requirements increase, quite often, the more cost effective on-site generation technology is pressure swing adsorption systems. Parker PSAs are the

industry standard for high performance and longevity, ensuring years of stable, trouble-free performance with the lowest energy costs.



A single-bed technology with fewer moving parts is available in flow rates from 200 to 1,000 SCFH at 99.9%. Installation can be indoor or outdoor, and is available in an optional Class 1, Div. 2, Group D Configuration.



Large, Custom PSAs are available from nitrogen flow rates from 6,000 SCFH to 120,000 SCFH from purities of 98% to 99.99%

## Applications:

- Pressure maintenance for depleted reservoirs
- Gas blending of high Btu pipeline gas
- Continuous gas lift operations at high purity
- Reservoir performance testing

## Engineered PSA Systems

Parker has supplied custom engineered systems to accommodate hazardous environment installations, extreme weather conditions, redundancy considerations and unique application requirements. Parker-NNI's engineering and manufacturing staff has addressed and solved many challenging project requirements with the development of highly custom designed systems.

Let our dedicated, knowledgeable staff review your unique project requirements and offer an engineered generator designed and built to your exacting specifications.



Open, Containerized Package  
Meets Class 1, Division 1, Groups C and D.  
Engineered Package for FPSO: 3,000 SCFH at 3,500 PSIG, 99.5% Nitrogen

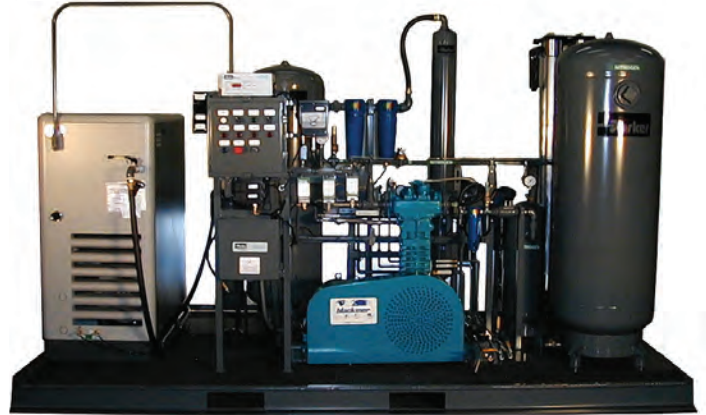
# Custom Non-Cryogenic N2 Generators



100% Redundant Membrane Package with Auto Switch-Over for Hazardous Environments

## Custom Engineering

What distinguishes Parker Hannifin from all other competitors is its willingness to build systems to detailed customer specifications, and the unwavering commitment to be the performance leader in both membrane and PSA technologies.



Aircraft Tire Filling Station with Gas Booster to 450 PSIG

## Custom Designed Units

In addition to our standard product lines, mono-beds and dual-beds, Parker has many years of experience in the design and manufacture of custom packaged PSA nitrogen generating systems. Parker offers the most complete line of membrane and PSA nitrogen gas generators in the industry. Parker's nitrogen systems are manufactured with unsurpassed craftsmanship under one roof to meet all of your purity, flow, pressure, and application requirements.

Specific design features to accommodate hazardous environment installations, extreme weather conditions, redundancy considerations and unique application requirements are available. Parker's engineering and manufacturing staff has addressed and solved many challenging project requirements with the development of engineered design systems.

Parker has dedicated, knowledgeable staff ready to lend their support to identify and overcome unique project challenges. Our custom designed systems can be found worldwide, providing dependable on-site, on-demand nitrogen gas production to a wide variety of industries.



Interior View of Containerized System

# Other Quality Products from Parker

## Coalescing Compressed Air Filters



- Remove 99.99% oil, water, and solids from compressed air and other gases
- Eliminate costs associated with shutdown time, maintenance, and rejected product
- Low pressure drop
- Services flow ranges from a few standard cubic feet to 40,000

## Sample Analyzer Filters



- Complete removal of solids and liquid impurities from gas samples
- Complete line of rugged housings in stainless steel, monel, PTFE and Kynar
- Fast loop sampling
- Inert, non-contaminating disposable filter element

## Vacuum Pump Inlet & Exhaust Filters



- Completely eliminate oil mist and smoke from vacuum pump exhaust
- Prevent oil accumulation in ductwork
- Prevent oil backstreaming
- Prevent loss of valuable or hazardous materials

## High Flow Rate Compressed Gas Filters



- Pressure rating to 1140 psig
- Meets U.S. and Canadian codes for natural gas filters
- Flow rates to 183 million standard cubic feet per day
- High efficiency removal of suspended liquid and solid impurities

## Membrane Air Dryers



- Offer dewpoints as low as -100°F (-73°C)
- Model SMART Dryer offers dewpoints to 35°F (2°C) with energy saving technology
- Explosion-proof
- Provide clean, dry, compressed air to process instrumentation

## Standard Membrane Nitrogen Generators



- Control your supply by providing the volume and purity required
- Eliminate the inconveniences and costs of cylinder gas supplies and dependence on outside vendors
- Produce up to 99.5% pure, commercially sterile nitrogen
- Dewpoints to -58°F (-50°C)

## Standard PSA Nitrogen Generators



- Compact - frees up valuable floor space
- Offer dewpoints as low as -70°F (-21°C)
- Produce 99.95% pure compressed nitrogen
- Complete package with prefilters, final filters, and receiving tank

## Gas Generators for Analytical Instrumentation



- Hydrogen generators for fuel and carrier gas applications
- Zero air generators for FIDs
- FID gas stations produce UHP zero air and 99.9995% hydrogen in one enclosure
- Ultra dry gas generators supply dry, purified compressed air to analytical instruments

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The items described in this document are hereby offered for sale at prices to be established by Parker Hannifin Corporation, its subsidiaries and its authorized distributors. This offer and its acceptance by any customer ("Buyer") shall be governed by all of the following Terms and Conditions. Buyer's order for any item described in this document, when communicated to Parker Hannifin Corporation, its subsidiary or an authorized distributor ("Seller") verbally or in writing, shall constitute acceptance of this offer.

**1. Terms and Conditions of Sale:** All descriptions, quotations, proposals, offers, acknowledgments, acceptances and sales of Seller's products are subject to and shall be governed exclusively by the terms and conditions stated herein. Buyer's acceptance of any offer to sell is limited to these terms and conditions. Any terms or conditions in addition to, or inconsistent with those stated herein, proposed by Buyer in any acceptance or an offer by Seller, are hereby objected to. No such additional, different or inconsistent terms and conditions shall become part of the contract between Buyer and Seller unless expressly accepted in writing by Seller. Seller's acceptance of any offer to purchase by Buyer is expressly conditional upon Buyer's assent to all the terms and conditions stated herein, including any terms in addition to, or inconsistent with those contained in Buyer's offer. Acceptance of Seller's products shall in all events constitute such assent.

**2. Payment:** Payment shall be made by Buyer within 30 days from the date of shipment. Amounts not timely paid shall bear interest at the Maximum rate permitted by law for each month or portion thereof that the Buyer is late making payment. Any claims by Buyer for omissions or shortages in a shipment shall be waived unless Seller receives notice thereof within 30 days after Buyer's receipt of the shipment.

**3. Delivery:** Unless otherwise provided on the face hereof, delivery shall be made F.O.B. Seller's plant. Regardless of the method of delivery, however, risk of loss shall pass to Buyer upon Seller's delivery to a carrier. Any delivery dates shown are approximate only and Seller shall have no liability for any delays in delivery.

**4. Warranty:** Seller warrants that the items sold hereunder shall be free from defects in material or workmanship for a period of 18 months from date of shipment to Buyer. THIS WARRANTY COMPRISES THE SOLE AND ENTIRE WARRANTY PERTAINING TO ITEMS PROVIDED HEREUNDER. SELLER MAKES NO OTHER WARRANTY, GUARANTEE, OR REPRESENTATION OF ANY KIND WHATSOEVER. ALL OTHER WARRANTIES, INCLUDING BUT NOT LIMITED TO, MERCHANTABILITY AND FITNESS FOR PURPOSE, WHETHER EXPRESS, IMPLIED, OR ARISING BY OPERATION OF LAW, TRADE USAGE, OR COURSE OF DEALING ARE HEREBY DISCLAIMED.

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**6. Changes, Reschedules and Cancellations:** Buyer may request to modify the designs or specifications for the items sold hereunder as well as the quantities and delivery dates thereof, or may request to cancel all or part of this order, however, no such requested modification or cancellation shall become part of the contract between Buyer and Seller unless accepted by Seller in a written amendment to this agreement. Acceptance of any such requested modification or cancellation shall be at Seller's discretion, and shall be upon such terms and conditions as Seller may require.

**7. Special Tooling:** A tooling charge may be imposed for any special tooling, including without limitation, dies, fixtures, molds and patterns, acquired to manufacture items sold pursuant to this contract. Such special tooling shall be and remain Seller's property notwithstanding payment of any charges by Buyer. In no event will Buyer acquire any interest in apparatus belonging to Seller which is utilized in the manufacture of the items sold hereunder, even if such apparatus has been specially converted or adapted for such manufacture and notwithstanding any charges paid by Buyer. Unless otherwise agreed, Seller shall have the right to alter, discard or otherwise dispose of any special tooling or other property in its sole discretion at any time.

**8. Buyer's Property:** Any designs, tools, patterns, materials, drawings, confidential information or equipment furnished by Buyer or any other items which become Buyer's property, may be considered obsolete and may be destroyed by Seller after two (2) consecutive years have elapsed without Buyer placing an order for the items which are manufactured using such property. Seller shall not be responsible for any loss or damage to such property while it is in Seller's possession or control.

**9. Taxes:** Unless otherwise indicated on the face hereof, all prices and charges are exclusive of excise, sales, use, property, occupational or like taxes which may be imposed by any taxing authority upon the manufacture, sale or delivery of the items sold hereunder. If any such taxes must be paid by Seller or if Seller is liable for the collection of such tax, the amount thereof shall be in addition to the amounts for the items sold. Buyer agrees to pay all such taxes or to reimburse Seller therefore upon receipt of its invoice. If Buyer claims exemption from any sales, use or other tax imposed by any taxing authority, Buyer shall save Seller harmless from and against any such tax, together with any interest or penalties thereon which may be assessed if the items are held to be taxable.

**10. Indemnity For Infringement of Intellectual Property Rights:** Seller shall have no liability for infringement of any patents, trademarks, copyrights, trade dress, trade secrets or similar rights except as provided in this Part 10. Seller will defend and indemnify Buyer against allegations of infringement of U.S. patents, U.S. trademarks, copyrights, trade dress and trade secrets (hereinafter 'Intellectual Property Rights'). Seller will defend at its expense and will pay the cost of any settlement or damages awarded in an action brought against Buyer based on an allegation that an item sold pursuant to this contract infringes the Intellectual Property Rights of a third party. Seller's obligation to defend and indemnify Buyer is contingent on Buyer notifying Seller within ten (10) days after Buyer becomes aware of such allegations of infringement, and Seller having sole control over the defense of any allegations or actions including all negotiations for settlement or compromise. If an item sold hereunder is subject to a claim that it infringes the Intellectual Property Rights of a third party, Seller may, at its sole expense and option, procure for Buyer the right to continue using said item, replace or modify said item so as to make it noninfringing, or offer to accept return of said item and return the purchase price less a reasonable allowance for depreciation. Notwithstanding the foregoing, Seller shall have no liability for claims of infringement based on information provided by Buyer, or directed to items delivered hereunder for which the designs are specified in whole or part by Buyer, or infringements resulting from the modification, combination or use in a system of any item sold hereunder. The foregoing provisions of this Part 10 shall constitute Seller's sole and exclusive liability and Buyer's sole and exclusive remedy for infringement of Intellectual Property Rights.

If a claim is based on information provided by Buyer or if the design for an item delivered hereunder is specified in whole or in part by Buyer, Buyer shall defend and indemnify Seller for all costs, expenses or judgments resulting from any claim that such item infringes any patent, trademark, copyright, trade dress, trade secret or any similar right.

**11. Force Majeure:** Seller does not assume the risk of and shall not be liable for delay or failure to perform any of Seller's obligations by reason of circumstances beyond the reasonable control of Seller (hereinafter 'Events of Force Majeure'). Events of Force Majeure shall include without limitation, accidents, acts of God, strikes or labor disputes, acts, laws, rules or regulations of any government or government agency, fires, floods, delays or failures in delivery of carriers or suppliers, shortages of materials and any other cause beyond Seller's Control.

**12. Entire Agreement/Governing Law:** The terms and conditions set forth herein, together with any amendments, modifications and any different terms or conditions expressly accepted by Seller in writing, shall constitute the entire Agreement concerning the items sold, and there are no oral or other representations or agreements which pertain thereto. This Agreement shall be governed in all respects by the law of the State of Ohio. No actions arising out of the sale of the items sold hereunder or this Agreement may be brought by either party more than two (2) years after the cause of action accrues.



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