

MANIPULATOR

INUKTUN SERVICES LTD.

2569 Kenworth Road, Suite C
Nanaimo, BC V9T 3M4
Canada

Toll Free: 1-877-468-5886
Tel: 250-729-8080
Fax: 250-729-8077
www.inuktun.com

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ABOUT THIS MANUAL

This manual has been prepared to assist you in the operation and maintenance of your Inuktun equipment. Correct and prudent operation rests with the operator who must thoroughly understand the operation, maintenance, service and job requirements. The specifications and information in this manual are current at the time of printing.

Inuktun reserves the right to change and/or amend these specifications at any time without notice. Customers will be notified of any changes to their equipment.

Information in this manual does not necessarily replace specific regulations, codes, standards, or requirements of others such as government regulations.

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DESCRIPTION AND SPECIFICATIONS

The Inuktun Manipulator was designed as a deep sea articulating gripper with an array of interchangeable jaw sets. The device is capable of high closing forces and provides an additional rotation feature to position the jaws in relation to the work piece. The pressure compensated housing allows the manipulator to dive to the depths of the ocean, and anodized aluminum and stainless steel 316 parts and fasteners allow it to thrive there. Individual jaw set functions are listed below.

Cutter	Cut nearly any material from plastic pipes, natural and synthetic ropes, even electrical cables.
Trident	For hard to hold objects, the trident grips sample from three equally spaced directions around the jaw's axis.
V Jaw	With a wide maw, the V jaw handles large objects with ease.
Parallel	Hard to hold and delicate objects are easily held in the jaw's always parallel top and bottom fingers.
Sampler	Take virtually any type of sample from silt and sediment to sea life and flora.

SPECIFICATIONS

Drive Unit	
Maximum Voltage	24VDC
Maximum Continuous Current	1.0A
Maximum Peak Current	1.7A
Maximum actuator force	90kgf [200lbf]
Maximum Rotation Speed	30RPM [0.5Rev/s]
Maximum Depth (Sea Water)	5000m [16,000ft]
Dry weight	0.9kgf [2.0lbf]
Wet Weight (Sea Water)	0.6kgf [1.4lbf]
Working Temperature	0-50°C [32-122°F]

Jaw Set	Closing Force (kgf)[lbf]				Weight (kgf)[lbf]				Max Work piece Size (cm)[in]	Time Open/ Close (s)
	Min		Max		Dry		Wet (SW)			
Cutter	82 [180]				0.25	[0.56]	0.17	[0.37]	2.3 [0.91]	7
Trident	7	[15]	20	[45]	0.31	[0.68]	0.19	[0.43]	15.2 [6.0]	5
V Jaw	5	[10]	18	[40]	0.29	[0.63]	0.17	[0.37]	17.5 [6.9]	7
Parallel	11	[25]	23	[50]	0.28	[0.61]	0.16	[0.35]	5.7 [2.3]	7
Sampler	5	[10]	18	[40]	0.30	[0.66]	0.16	[0.36]	45ml [1.5oz]	7

**Min and Max closing forces are at the tip and base of the jaws, respectively.*

SYSTEM SETUP

SAFETY

- All personnel operating or maintaining this equipment must read and understand the operations and maintenance manual prior to system operation.
- All personnel operating or maintaining this equipment must be competently trained.
- Appropriate personal protective equipment (PPE) must be worn while operating and maintaining the equipment.
- Under no circumstances should this equipment be used in a potentially explosive atmosphere.
- If the equipment is powered from a source other than an Inuktun provided controller, the power supplied to the product must have reinforced isolation from the mains with no reference to earth ground.
- **Mechanical Pinching Hazard.** All the interchangeable jaw sets have enough force to seriously injure one's fingers, and the cutter attachment could easily sever a human digit. Always power down the manipulator while someone is working on or near the jaws.
- **NEVER** operate the manipulator without a jaw set attached. Operating without a jaw set may result in jamming of the centre actuator.

Caution: Disconnect the power source before servicing the product; otherwise, damage may result.

WORKING ENVIRONMENT

The manipulator is designed for use on land or down deep in fresh/salt water (5000m max). Before using the manipulator, make sure all parts are moving freely and there are no obstructions to the jaw set attached. All metallic parts were designed to withstand a harsh salt water environment, but it is recommended that the unit be thoroughly washed down with fresh water after every use. Use only standard line pressures; **pressure washing may damage o-ring seals.**

CONNECTOR HANDLING

With regard to system reliability, connectors are very important to maintaining a fully functioning system. A damaged connector can represent significant costs in downtime and retermination which could easily have been prevented. To this end, Inuktun recommends the following steps to help prevent damage to connectors.

When plugging in a connector:

1. Inspect for dirt in both sides of the connectors. Do not plug in a dirty or damaged connector.
 - a. Inspect for bent or burnt pins.
 - b. Visually align the locating flat first before plugging in. **Do not blindly jam and twist.**
 - c. Fully tighten or engage a connector. Never use a connector partly plugged or screwed in. Contacts left partly open may be subject to leaking, arcing or burnout.
2. Regularly apply silicone grease to the connectors to keep them from seizing.

The manipulator has only one connector on the back end of the drive unit. 24VDC max and communications are supplied through this connector with the pin configuration shown below – note that the view is looking at the face of the connector on the drive unit, **not the connecting whip**.

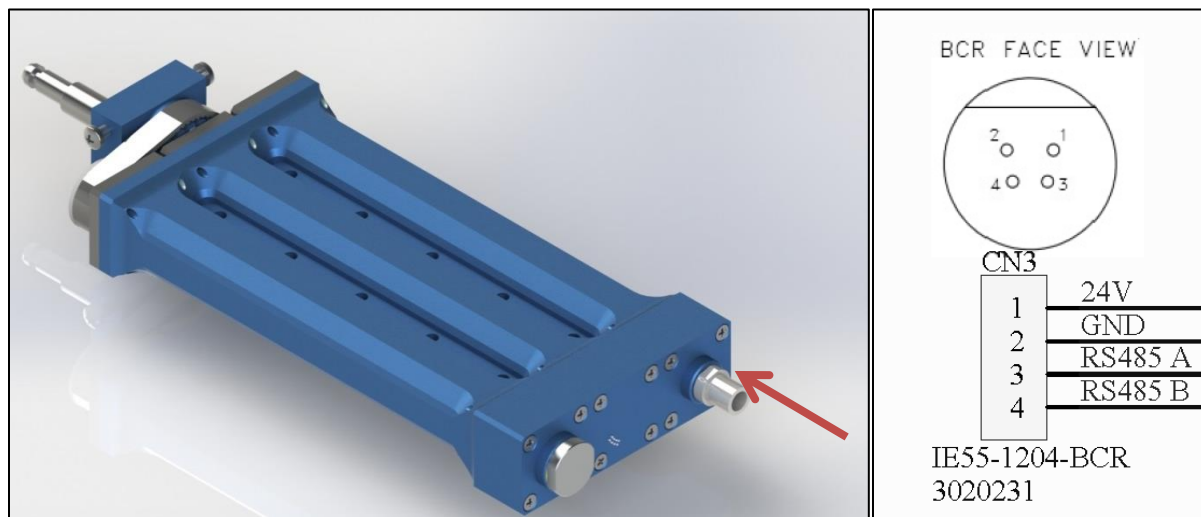


Figure 1: Manipulator Connector

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CHANGING JAW SETS

The manipulator has five (5) standard jaws from which to choose from. All offer unique characteristics and advantages for different operating requirements. The jaws are easily interchangeable. To uninstall the V Jaw, Parallel Jaw, and the Sampler, follow the steps listed below (installation is the opposite of removal):

1. Close the jaws (or piston if no jaw is attached) to approximately halfway of its stroke.

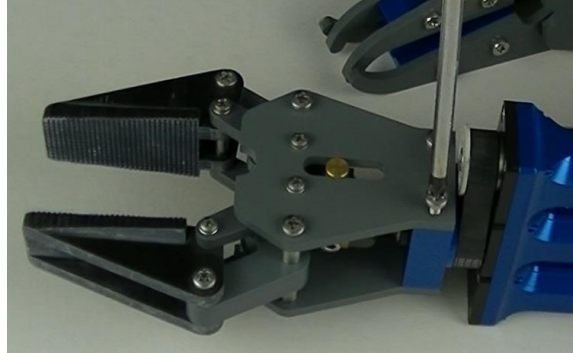


Figure 2: Screw Removal

2. Remove the M4x10 pan head screws (x4) from the jaw side plates that hold it on to the square collar.

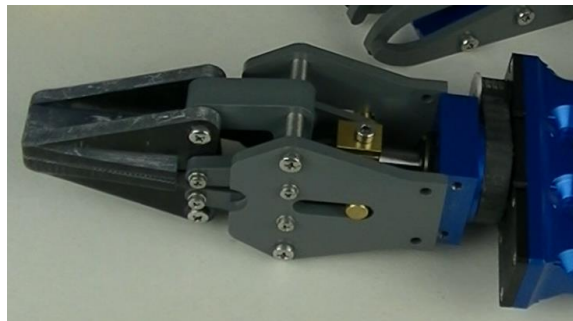


Figure 3: Closed Jaws

3. Manually close the jaws, drawing the side plates forward and fully exposing the actuator end clips.



Figure 4: Manually Closed Jaws

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4. Remove the M4x8 socket cap screws (x2) and end clips from the actuator end block.
5. Remove the jaw assembly from the drive unit by gently sliding it forward off of the actuator shaft.

Installation of the Trident is similar to above except for the actuator end clips. These also hold the centre engaging rack on and have 4x M4x8 socket cap screws which must be removed before the jaw can slide off the actuator shaft. Once the jaw is removed, always reinstall the rod end clips into the centre rack and end block to prevent loss of parts.

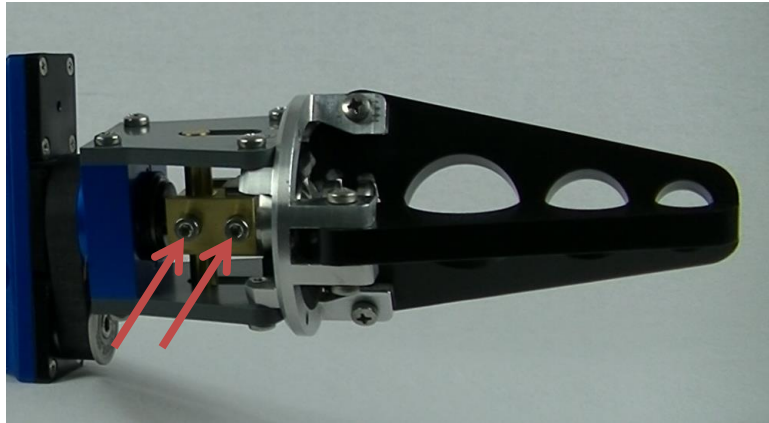


Figure 5: Trident Screws

Installation and removal of the Cutter is also similar to the other jaw sets. Once the side plate screws are removed, extract the standard end clip from the actuator shaft. Flip the jaw over, remove the indicated screw on the blade mount, and swing the back of the side plates down and away from the centre axis until the actuator rod is clear. The jaw may then be slid forward and removed. Always reattach the actuator end clip to the end block to prevent loss of parts.

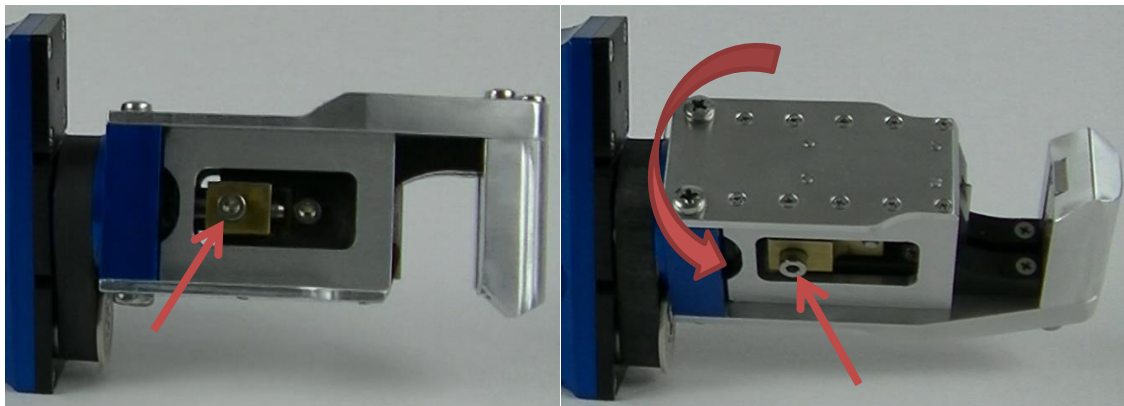


Figure 6: Cutter Screws

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MAINTENANCE

CLEANING

In order to ensure the manipulator functions well, it should always be thoroughly cleaned after every use. Always use fresh water at standard line pressure (700kPa/100psi max). Always make sure to drain any water from the bellows port (small hole) on the front of the housing. Failure to clean properly could result in premature corrosion of components.

CUTTER BLADES

POST-DEPLOYMENT

The cutter blades are made from specially coated steel that will resist corrosion in salt water. However, due to the extremely corrosive nature of seawater on even the noblest materials, the blades should be properly cared for after use:

1. Cleanse with freshwater after every use.
2. Dry the blade and apply machine oil or grease to all surfaces.

Failure to care for the blade as described above will result in premature degradation.

SHARPENING

If the cutter blades need to be re-sharpened, they can be sharpened numerous times using standard methods. Always make sure to leave a perfectly straight edge – irregularities or loss of perpendicularity could result in compromised cutting ability. For replacement blades contact your Inuktun representative.

COMPENSATION OIL

The manipulator unit is pressure compensated with light, food safe oil to ensure reliable operation at depth. If a new manipulator has been sitting on the shelf for an extended period of time, or has recently been shipped via air, it is possible some of this oil may “weep” out of the o-ring grooves. This can be alarming as it will appear as though the unit is leaking; in most cases, though, it is nothing to worry about.

To verify if there is a leak in the unit, perform the following procedure (this same process should be repeated annually to ensure the integrity of the housing seals):

1. Wash the manipulator body with hot soapy water (dish detergent work best), and heat the body up to 40°C to 50°C (Approx. 104°F - 122°F). The soap will remove any oil, and the hot water should help with moving the oil from the cracks.
2. Allow the unit to dry
3. Place the dried unit on a facial tissue (or similar) in a warm area; if oil marks or slicks appear on the tissue within a few minutes it could indicate a failure of one of the housing seals. Contact your customer service representative to arrange for repairs.

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At least once a year, check the quality of the oil by completing the following steps.

1. Insert an M3x25 socket cap screw into the bellows piston through the bellow port (see Figure 7 below) such that it *gently* seats on the front cap. **Failure to do this will result in loss of oil.**
2. With the drive unit held back up and jaws down, gently unscrew the oil plug on the back of the unit; if the oil level is not near the top of the opening there could be a leaking seal and you should contact your customer service representative.
3. Gently dip your finger in (do not splash out too much oil) and test the quality. The oil should have a slick feel and should not be gritty or excessively dirty. If the oil is extremely degraded or dirty, contact your customer service representative for an oil change or to receive a kit to change the oil.
4. Before replacing the oil plug, top up the oil so that it is filled to the brim – use Schaeffer’s ISO 22 food safe hydraulic oil. **Failure to top up the oil can result in air inside the housing, loss of pressure compensation and failure at depth.**

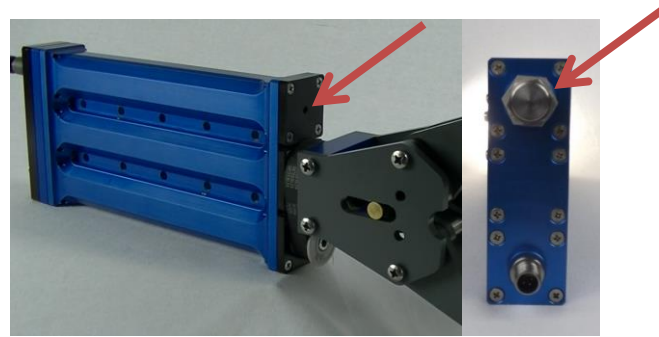


Figure 7: Bellows Piston and Oil Port

DISLODGING THE CENTRE ACTUATOR

NEVER operate the manipulator without a jaw-set attached. If it has been operated without a jaw-set attached and the centre actuator has become jammed and cannot be moved with maximum power from the controller, the following procedure can be undertaken which **may** solve the issue.

WHILE EXTENDED

If the centre actuator is jammed in the fully extended position, without a jaw-set attached, try to close the actuator with full force from the controller while gently tapping on the tip of the rod with a light hammer. Make sure the housing is secured to a table or surface to provide stability.

If the actuator is jammed in the closed position, follow one of the following procedures.

Preferred:

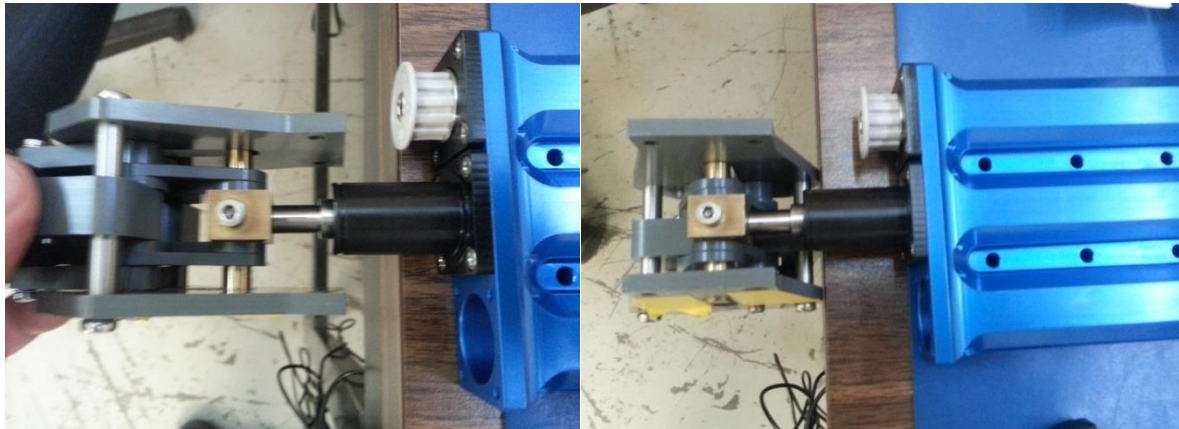
1. Locate a flat slotted tool that can fit in the groove at the end of the centre actuator. The slot should be 5.3 – 6mm [0.21 – 0.24in] wide, and the tool should have a thickness no greater than 3mm [0.12in].
2. Place the manipulator onto a table.
3. Insert the tool into the actuator end groove and brace it against the edge of the table.

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4. While pulling the manipulator against the braced tool (as in trying to pull the actuator out), and applying full open force from the controller, gently tap on the tip of the actuator with a light hammer.

Alternative - If a flat slotted tool cannot be found or made, one of three jaw-sets (Sampler, V- or Parallel Jaws) may be used instead by doing the following:

1. Using one of the jaws, fasten the centre actuator end block onto the actuator shaft with the mount clips – do not slide the end block onto the shaft – leaving the smaller shaft diameter exposed. The end block is thus rotated 180° from normal installation.



2. Place the manipulator onto a table.
3. Pivot the jaw-set 90° and brace the side-plates against the edge of the table.
4. While pulling the manipulator against the braced jaw-set (as in trying to pull the actuator out), and applying full open force from the controller, gently tap on the front of the end block with a light hammer.

PARTS AND REPAIRS

ORDERING PARTS/CUSTOMER SERVICE

Spare and/or replacement parts are available for your product and can be ordered directly from your local office.

When ordering parts, always make sure to quote the sales order acknowledgement (SOA) number and/or the serial number of the system component in question.

Canada	United States of America	Europe	Asia
Inuktun Services Ltd.	Inuktun US, LLC	Inuktun Europe Ltd.	Inuktun Asia Pte Ltd.
2569 Kenworth Road	103 Rio Rancho Drive NE	Unit 3 Crombie House	16 Boon Lay Way
Suite C	Suite A-6	Grandholm Village	#01-43 TradeHub21
Nanaimo, BC V9T 3M4	Rio Rancho, NM 87124	Bridge of Don	Singapore 609965
		Aberdeen, Scotland AB22 8BD	
Phone: 250-729-8080	Phone: 505-994-0702	Phone: +44-1224-701444	Phone: +65-9383-6270
Fax: 250-729-8077	Fax: 505-994-0726	Fax: +44-1224-853860	Fax: +65-6795-4222
TF: 1-877-INUKTUN	TF: 1-877-INUKTUN		
service@inuktun.com	service@inuktun.us	service@inuktun-europe.com	info@inuktun-asia.com

WARRANTY REPAIRS

Warranty conditions are specified in the Warranty section. Should any conditions of the manufacturer's warranty be breached, the warranty may be considered void. All returned items must be sent prepaid to Inuktun at the above address.

FACTORY RETURNS TO CANADA

Some sub-assemblies of your Inuktun product are not field-serviceable and may need to return to the factory for repair. Warranty claims must return to the factory for evaluation.

To return an item for evaluation or repair, first contact Inuktun at our toll-free number or e-mail address. Inuktun will supply a Return Merchandise Authorization (RMA) number with detailed shipping and customs instructions. Items shipped without an RMA number will be held at Inuktun until the correct paperwork is completed. If cross-border shipments are not labelled as per the instructions, the items may be held by customs and issued additional fees.

All returned items must be sent prepaid unless other specific arrangements have been made.

When the product or system is being shipped anywhere by courier or shipping company, it must be packaged in the original packaging it was received in. This measure greatly reduces the consequences of rough handling and subsequent shipping damage.

Inuktun cannot be held responsible for damages due to improper packaging. Shipping damage may have significant impact on repair turnaround times.

PRODUCT/SYSTEM DRAWING PACKAGE AVAILABILITY

Mechanical assembly and electrical wiring diagram drawing packages for your equipment are available in PDF format upon request. Printed copies may also be purchased from Inuktun. Contact your local sales contact for more information.

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LIMITED WARRANTY POLICY

Inuktun will repair or replace, at its expense and at its option, any system or component, subject to the limitations and / or exclusions specified herein, which in normal use has proven to be defective in workmanship or material provided that, within one (1) year of the purchase date, the original purchaser returns the product prepaid, accompanied by proof of purchase, from a sales agent authorized by Inuktun, and provides Inuktun with reasonable opportunity to verify the alleged defect by inspection.

Warranty Limitations and/or Exclusions:

1. This warranty does not apply to light bulbs.
2. Batteries, fuses, transistors, integrated circuit modules (IC's), voltage regulating devices and electrical plugs and / or connectors are warranted to be free from defects in material and workmanship for a period of ninety (90) days from the date of shipment to the original purchaser.
3. Any article purchased from, but not manufactured by, Inuktun is sold with only such warranties as are made by the manufacturer therein. Inuktun only warrants that it has title thereto, free of all liens or encumbrances.
4. This warranty does not apply to units which are damaged by connection to improperly wired AC receptacles.
5. Track belts, tethers, view ports and other components subject to wear through abrasion are warranted to be free from defects in material and workmanship for a period of ninety (90) days from the date of shipment to the original purchaser.
6. Any damage caused by failure to observe proper packing or to observe instructions for operation and maintenance as contained in the Instruction Manual furnished with the equipment, by accident in transit or elsewhere, will not be covered by the warranty.
7. Repairs are warranted for 90 days.

Inuktun may require that certain components may be returned, prepaid, to a manufacturer's authorized station for inspection and repair or replacement.

Inuktun will not be responsible for any asserted defect which has resulted from Acts of God, normal wear, misuse, abuse, improper configuration, repair, or alteration made, or specifically authorized by, anyone other than a representative of Inuktun authorized to do so. The giving of, or failure to give, any advice or recommendation by Inuktun shall not constitute any warranty by, or impose any liability on, Inuktun.

The foregoing constitutes the sole and exclusive remedy of the purchaser and the exclusive liability of Inuktun and is in lieu of any and all other warranties, express, implied or statutory as to merchantability, fitness for purpose sold, description, quality productiveness, or any other matter. Under no circumstances shall Inuktun be liable for special, incidental or consequential damages, or for delay in performance of this warranty.

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