

Operating and maintenance instructions

Cutting head food safe type X 2.0 (4150 bar / 60,000 psi)



ALLFI AG - Riedenmatt 1 – CH-6370 Stans Phone: +41 41 618 05 05 E-Mail: info@allfi.com - <u>http://www.allfi.com</u> October 2023 General



Scope

This installation and maintenance manual is valid for the following Type X 2.0 (4150 bar / 60,000 psi) food safe cutting heads.

- 907810
- 907820



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Appendix A – Technical drawing and bill of materials



1 General

1.1 Information on how to use the operation and maintenance instructions

This operation and maintenance manual is part of the product in addition to the cutting head. It must be carefully read and understood by the person working with the cutting head before any work is carried out. The manual must be stored in distance as well as always accessible to the persons, working with the cutting head.

Should you have any questions regarding the content of the manual, please contact the manufacturer directly.

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1.2 Scope of delivery

The individual parts included in the delivery can be found in the bill of materials in Appendix A (Technical Drawing and part list). Upon receipt of the delivery, it must be checked for completeness and integrity according to the parts list. Any defects found must be reported to the manufacturer immediately.

1.3 Warranty

ALLFI AG grants the following guarantees for the parts included in the delivery:

- > material and manufacturing quality of 12 months from the date of delivery or
- > Defects within the first 2,000 hours of operation

The following wear parts are excluded from the warranty, such as:

- > Seal Kit (consisting of valve needle, high-pressure seal 2.0 and pressure plate 2.0)
- Valve seat
- Orifice
- Collimation Tube
- O-Rings
- Valve case

1.4 Disclaimer

ALLFI AG refuses any claims of liability (material damages, physical injury, as well as disruption of operation), that are a result of disregarding this operating and maintenance instruction.

For example, the damage as a consequence of:

- > Inadmissible application of the cutting head
- Defective maintenance
- > The disregard of operation instructions
- > Chemical and electrolytical influences
- > Use of parts, spare parts or accessory from a third-party manufacturer
- Arbitrary modifications
- > Not or insufficiently trained staff



The disregard of all these instructions happens on exclusive risk and exclusive responsibility of the client. The ALLFI AG is not liable for any production downtimes.

2 Safety

2.1 Declaration of symbols

This operating and maintenance instruction manual contains important notes and symbols, which are to be considered and followed. These include:



2.2 General warning notes

Using of the cutting head, the following warnings are to be considered.



The specified warnings are not only restricted to the operation with the maximal permissible operating pressure of 4150 bar / 60,000 psi. They are also valid on work with reduced operation pressures!



Danger of cutting of extremities on contact with waterjet

The contact with the high kinetic energy performing waterjet can have the consequence of cutting of extremities or lead to other injuries.

Therefore:

- Operate the machine only, when nobody stands in the danger zone of the waterjet.
- Never touch the waterjet, not even with personal protective equipment.
- Always sufficient safety distance during operation of the cutting head.
- > Never guide the cutting head by hand during operation.



Any injuries in connection with the waterjet, alarm the emergency doctor immediately.

Danger of breathing difficulties and irritation of the skin and eyes by released solid particles or dust.

During machining of certain material, solid particles and dust may float in the air, which could cause breathing difficulties and irritations to the skin and eyes.

Therefore:

- Ensure the proper ventilation of the room surrounding the machinery.
- Ensure to wear the personal protective equipment (protection glasses, breathing mask, gloves, ...)



Additionally, the rules and regulations of the working place are to be followed to prevent injuries!

2.3 Intended use

The cutting head is designed to generate a water jet that can be switched on and off, which can be used to cut materials of various thicknesses and hardnesses. The cutting head must be firmly connected to the machine. It may only be operated with compressed air. Only pure water is to be used as the working fluid. Precautions must be taken to ensure that neither liquid escaping under high pressure nor flying debris can injure people. The limit values must always be complied with.

2.4 Prohibited Use

Prohibited use of the cutting head includes, but is not limited to:

- > The usage of all other fluids other than water
- > The addition of other substances to the water
- > Closure of the pressure relief holes
- > Manually guide the cutting head by hand
- > Excessive application of the cutting head e.g. large fluctuations in pressure
- Exceeding permitted limits
- > Operating the valve with demounted or disabled technical protection
- > Use the cutting head as a security valve

Likewise, the uses listed below are considered prohibited in the absence of appropriate technical protective measures to protect the operator, other groups of people, the machine components themselves or the environment:

The cutting of materials that release harmful, aggressive or explosive substances in the form of dust, microparticles or gas.

Likewise, all other uses of the cutting head that deviate from the intended use are considered inadmissible. If you have any questions or uncertainties, please contact the manufacturer directly.

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2.5 Residual risks

The manufacturer and/or operator of the machine where the cutting head is built in, has taken every precautionary measure possible to reduce residual risks, as far as possible reasonably practicably.

Operation phase Damage		Danger	Reason	(possible) measures	
		Liquids leaking under high pressure (e.g. at pressure relief holes)	Ignoring the torque	Follow the torque	
			Damaged sealing surfaces	Regular	
			Busted/Cracked connections and	supervision	
			high-pressure components as a result of defects	Protective wall as a technical protective measure	
	Physical injuries	Physical injuries Flying fragments	Ignoring the torque	Follow the torque	
Operation			Damaged sealing surfaces	Regular	
			Busted/Cracked connections and high-pressure components as a result of defects	supervision	
				Protective wall as a technical protective measure	
		Uncontrolled water iet	Spring fracture	Scheduled service (chapter Fehler! Verweisquelle	
		,		gefunden	
				werden.)	





	Physical injuries	High kinetic energy of water jet	Intrusion of extremities in working area of water jet	Technical protective measures or inherently reliable construction of the machine
		High kinetic energy of residual water jet		Use correctly dimensioned water jet absorber
Operation		Particles of raw material and splash water Rapidly discharging of	Cutting of material	Wear protection glasses and personal protection equipment
				Splash-water protection for technical protective measure
	Hearing			Wear ear protector
	damage	fluid		Use correctly dimensioned water jet absorber

2.6 Safety

The manufacturer or the operator of the full machine, which the cutting head is built in, has ensured the following safety arrangements:

- > Protection against intrusion of extremities in working area of water jet
- > Safety devices to prevent flying fragments or liquids leaking under high pressure
- > Emergency stoppage to immediately shut down the operating machine
 - → Active: Manually triggered by operator
 - → Passive: Automatically triggered by:
 - \circ o Penetration of limbs into the working area of the water jet
 - o Failure of high pressure components or gross operating faults
 - o o Collision of the cutting head with fixed parts



Danger for the operator will arise if safety protections are not functionally, not followed or evaded anytime. The operator has to ensure the functionality of the safety protections anytime.

2.7 Personal Protective Equipment

The operator shall provide his personnel with the following protective equipment while working with the cutting head:



Safety





Safety goggles against:

- Spray mist and dust particles
- Flying Parts

Hand guards against:

- Sharp edges of components
 Intrusion of micro particles into the skin

Inhalation protection against: > Dust particles, micro particles and spray mist

2.8 Qualification of staff

The cutting head may only be operated and maintained by certified, trained staff.



3 Structure and function of the cutting head

3.1 Construction

The upper half of the cutting head is encapsulated with a stainless steel hood. This makes it easy to clean. Any leakage comes out of the bottom of the housing (see chapters 5 and 8).



Pos.	Pcs.	Object	
1	1	Pneumatic Cylinder Type X 2.0	
2	1	Seal Kit 2.0	
З	1	Valve seat	
4	1	Collar 1/4"	
5	1	Valve case 2.0 food safe	
6	1	Gland nut 1/4"	
7	4	Cover food safe	
8	1	Orifice food safe	
9	4	Collimation Tube	
10	1	Jacket food safe	
11	1	O-Ring	
12	1	O-Ring	
13	1	O-Ring	
14	1	O-Ring	
15	1	O-Ring	
16	1	Pneumatic plug Ø6	
17	1	Orifice	
18	2	Spacer	

3.2 Function

The cutting head opens and closes by means of a pneumatic piston drive, whereby the cylinder is lifted against the spring force by feeding compressed air into the pressure chamber. Lifting lifts the valve needle out of the valve seat and opens the water channel. By releasing the compressed air, the cutting head closes with the appropriate spring force. The compressed air supply is switched on and off via a controlled valve (not included). The maximum allowable operating pressure of the water is 4150 bar / 60,000 psi.



3.3 Accessories

		TO MARIE	
Article:	End Hole Wrench	P-Paste	Ejection mandrel
Article:	040006	051065	907224
Function:	Adjusting the Hub	Lubrication of bolted joints and metallic sealing surfaces	Seal Kit and valve seat replacement

	-		
Article:	Torque wrench	Open-end wrench	Assembly tool for O-ring
Article:	000468	SW 15 – 000493 SW 17 – 000339 SW 22 – 000272	040011
Function:	Tightening bolted connections with predefined torque		Assembly and disassembly of O-ring

Article:	Open-end wrench SW 55	Sealing plug 1/4"
Article:	907818	151410
Function:	Counter-Hold Pneumatic Cylinder	Positioning the valve body



4 General Technical Data

Pneumatic Pressure:	6 - 7 bar / 87 - 102 psi
Minimum Operating Pressure:	500 bar / 7250 psi
Maximum Operating Pressure:	4150 bar / 60,000 psi
Maximum operating temperature:	50 °C
Maximum temperature during Transport and storage:	60 °C
Reaction time:	Up to 2 switching cycles per second
Weight:	ca. 1.4 kg
Noise emission:	70 - 120 dB (a), depending on orifice size and beam catcher design

Required water quality:

Water Parameters	Unit	Value
Conductivity	µS/cm	100 – 450
рН	-	7.0 - 8.5
Total hardness	°dH	2.0 - 10.0
Carbonate hardness (acid capacity pH 4.3)	°dH	2.0 - 10.0
Base capacity pH 8.2	MMOL / L	0 - 0.25
Chloride	mg/l	≤ 50
Iron	mg/l	≤ 0.2
Manganese	mg/l	≤ 0.05
Copper	mg/l	≤ 2.0
Silicate	mg/l	≤ 5.0
(Filtrate) Dry residue	mg/l	≤ 350

5 Installation and commissioning

General Installation Instructions:

- > Do not use a compressed air lubricator.
- > Compressed air filter with water separator must be installed.
- The compressed air filter and switching valve must be designed for a nominal flow rate of around 5 m3/h.
- Before connecting the cutting head, care must be taken to ensure that the pressure-conveying cables are absolutely clean.
- High-pressure filter in front of the cutting head is recommended to extend service life (e.g. ALLFI HD filter 931335).
- If you are installing for the first time, follow the corresponding sub-chapters step by step.





Risk of injury due to unauthorized closing of the pressure relief openings

By closing the pressure relief openings, the pressure inside the cutting head cannot escape in the event of a leak. As a result, the cutting head or parts of it may explode.

Therefore: Do not close pressure relief openings.



Positions of the pressure relief openings

HINT

Damage to property as a result of grazing

Threads and contact surfaces that are not greased or insufficiently greased can corrode when tightened.

Therefore:

Always grease the thread and all metallic contact surfaces with assembly paste according to Appendix A.

HINT

Property damage or leakage due to contamination

Contamination of components, especially threads, can lead to leaks or damage.

Therefore:

During installation, pay attention to the cleanliness of the components.



HINT

Property damage due to leaks

In the event of a prolonged leakage, consequential damage can occur.

Therefore:

Eliminate leaks immediately (see chapter 8 "Faults and Troubleshooting").

5.1 Attachment of the cutting head to the machine









5.2 Rinsing the cutting head

Attention! Cap must not be screwed on!

- 1. Unscrew the cap in accordance with Chapter 7.2.
- 2. Pressurize the pneumatic cylinder with compressed air.
- 3. Rinse the cutting head with water ($p \le 500$ bar) for 5 to 10 seconds.
- Install the cap with the orifice inserted on the collimation tube in accordance with chapter 7.2. Orifice type see Appendix A

HINT

Possible property damage due to direct transmission of torque to highpressure sealing points

When tightening or loosening the cap without holding the collimation tube against it, the torque is transferred directly to the sealing cone, which can damage the sealing surfaces.

Therefore:

Counter-hold the collimation tube when tightening or loosening the cap.





5.3 Functional control of the cutting head



Switch the cutting head on and off several times under operating conditions (water pressure = operating pressure). Check the following points:

- Error-free opening and closing
- > No delays in opening and closing
- > Beam quality at the outlet of the orifice
- Tightness of the cutting head

If all tested points are working, the cutting head is ready for normal operation. In the event of deficiencies identified, reference should be made to the chapter 8 "Faults and troubleshooting".

6 Uninstall



Before uninstalling, depressurize the high-pressure and compressed air line.



- 1. Remove the compressed air hose.
- 2. Removing the high-pressure line
- 3. Loosen both M5 screws and remove the cutting head

7 Maintenance, servicing, and repair





Before any manipulation of the cutting head, release the pressure from the high-pressure and pneumatic hoses. Make sure the pressure is not rebuilt.

All maintenance, servicing and repair work not listed in this chapter must be carried out by the manufacturer. This applies in particular to work on the pneumatic cylinder.

HINT

Property damage or leakage due to contamination

Contamination of components, especially threads, can lead to leaks or damage.

Therefore:

During installation, pay attention to the cleanliness of the components.

HINT

Possible material damage due to direct transmission of torque to highpressure line

When the cap is loosened or tightened without holding the collimation tube against it, the torque is transferred directly to the cone of the HD line. As a result, the cone can be damaged.

Therefore:

Counter-the collimation tube when loosening or tightening the cap.

HINT

Damage to property as a result of grazing

Threads and contact surfaces that are not greased or insufficiently greased can corrode when tightened.

Therefore:

Always grease the thread and all metallic contact surfaces in accordance with Appendix A.



7.1 Regular maintenance

What	By whom	When
Replace disc springs and the O-	Service ALLELAG	Every 2000 operating hours /
rings of the pneumatic cylinder	Service ALEI I AG	1 million switching cycles
Check your hub	Operator	Every 500 operating hours /
		100000 switching cycles
Checking for leaks	Operator	Perpetual
Check beam quality	Operator	Perpetual

7.2 Orifice Replacement



7.3 Collimation Tube Replacement

	 Make sure that the high-pressure line is depressurized and the cuttin head is closed. 	ıg
1	 Unscrew the cap from the collimation tube. Attention! Counter the collimation tube. 	er



		1.	Pressurize the pneumatic cylinder with compressed air (6-7 bar). This relieves pressure on the valve needle.
		2.	Screw the collimation tube out of the valve body. Attention! Hold against the valve body.
2		3.	Grease the thread of a new collimation tube (see Appendix A).
		4.	Screw and tighten the new collimation tube into the valve body. Attention! Hold against the valve body. Torque see Appendix A.
		5.	Pneumatic cylinders relieve pressure.
3		1.	Cap on collimation tube screw torque see Appendix A Attention! Counter the collimation tube.
		2.	Perform a functional check in accordance with Chapter 5.3.

7.4 Invert (turn) valve seat

1	 Make sure the high-pressure line is depressurized. 	line is
	 Pressurize the pneumatic cylinder with compressed air (6-7 bar). This relieves pressure on the valve needle. 	nder . This e
	 Screw the collimation tube out of th valve body. Attention! Hold agains the valve body. 	t of the gainst
2	 Use the tool 040001 to remove the O-ring that is inside the valve body below the valve seat. See pictures of the next step. 	e the body tures



3	Groove at	 Remove the valve seat from the valve body. Pay attention to the orientation of the valve seat (groove at the top or bottom) for step 9 below. 	
		When groove is up:	
4		Valve seat can be reinstalled with groove at the bottom.	
		When groove is down:	
		Since both valve seats are now worn, the valve seat has to be replaced with a new one and installed with a groove at the top. It is recommended to change the Seal Kit as well. (See Chapter 7.5).	
		Insert the O-ring 040011 into the valve body with the assembly tool to secure the valve seat.	
		 Pressurize the pneumatic cylinder with compressed air (6-7 bar). This relieves pressure on the valve needle. 	
5		2. Grease the thread of a new collimation tube (see Appendix A).	
		 Screw the collimation tube into the valve body and tighten it. Torque see Appendix A. 	
		 Pneumatic cylinders relieve pressure. 	

7.5 Seal Kit and valve seat replacement



To change the gasket set and valve seat, it is imperative to remove the cutting head from the machine.

- 1. Remove the cutting head from the machine. (Chapter 6).
- 2. Connect the compressed air hose.
- 3. Pressurize the pneumatic cylinder with compressed air (6-7 bar). This relieves pressure on the valve needle.
- 4. Screw the collimation tube out of the valve body. **Attention!** Hold against the valve body.
- 5. Relieve pressure on the pneumatic cylinder and remove the pneumatic line.







7	1.	Pull the valve body out of the jacket.
8	1. 2. 3.	Place the valve body on a firm surface as shown in the illustration (needle point upwards). Use the ejection mandrel to push the gasket set out of the valve body. Discard the old Seal Kit.
9	1. 2.	Grease the outer cone and pressure surface of the support washer of the new Seal kit in accordance with Appendix A. Put the new gasket set on the pneumatic cylinder.
10	1. 2.	Slide the jacket over the valve body Align the two parts so that the thread for the high-pressure connection aligns with the corresponding hole in the valve body.
11	1.	Grease O-rings Pos 13 and 14 and insert them into appropriate grooves (see also Appendix A). Secure this position with the sealing plug 151410. Just tighten it tightly.
12	1.	Screw the valve body and jacket onto the pneumatic cylinder by hand.



13		 Clamp open-end wrench SW 52 (907818) in vice (see picture) Insert the pneumatic cylinder with an open-end wrench Tighten the valve body to SW 22. Torque see Appendix A. 	
		If groove was up at step 3: Valve seat can be reinstalled with	
		groove at the bottom.	
14		Since both valve seats are now worn, the valve seat has to be replaced with a new one and installed with a groove at the top.	
		Insert the O-ring 040011 into the valve body with the assembly tool to secure the valve seat.	
		1. Connecting the compressed air hose	
		 Pressurize the pneumatic cylinder with compressed air (6-7 bar). This relieves pressure on the valve needle. 	
15		 Clean and grease the thread of the collimation tube (see Appendix A). 	
		 Screw the collimation tube into the valve body. Attention! Hold against the valve body. Torque see Appendix A 	
		 Relieve pressure on the pneumatic cylinder and remove the pneumatic line. 	
		 Adjust the stroke of the pneumatic cylinder. (Chapter 7.6) 	
16		Press the lid onto the housing with small twisting movements.	
		3. Removing Sealing Plug 151410	
		 Install the cutting head in the machine. (Chapter 5.1) 	
		5. Perform a functional check in accordance with Chapter 5.3.	



7.6 Adjusting the stroke of the pneumatic cylinder







8 Faults and troubleshooting

Before repairing any faults, depressurize high-pressure and compressed air lines.

Attention! After all fault corrections, a functional check of the cutting head must be carried out in accordance with chapter 5.3.

8.1 Leakage at the cutting head:





Item of leakage	Possible causes of leakage	Measures	Chapter
	Defective HD gasket	Seal Kit Replacement	7.5
1	Sealing cone on valve body or support washer damaged	Replacing Damaged Parts	7.5
Searkit	Pneumatic cylinder tightening torque not correct	Tightening with prescribed torque	7.5
	Water pressure too high	Consider application limits	
2	Tightening torque of the fitting of the HD line not correct	Tighten the pressure screw of the HD cable	5.1
HD fitting	Sealing cone on HD cable damaged	Cone from HD line to cut	
3 Sealing Point	Tightening torque of collimation tube not correct	Tighten the collimation tube	7.3
Housing – Valve Seat	Sealing surfaces damaged	Replace valve seat and/or valve body	7.4
4 Sealing Point	Tightening torque of collimation tube not correct	Tighten the collimation tube	7.3
Valve Seat – Collimation Tube	Sealing surfaces damaged	Replace the valve seat and/or collimation tube	7.3 / 7.4
5 Sealing point	Orifice/Cap Tightening Torque Not Properly	Tightening the cap	7.0
collimation tube – orifice	Sealing surfaces damaged	Orifice Replacement	1.2
	Foreign body in valve seat	Eliminate foreign bodies	
6 Sealing Point	Sealing surfaces damaged	Replace Seal Kit and/or valve seat	7.4
Valve Needle -	Valve lift incorrectly adjusted	Adjusting the valve lift correctly	7.6
Valve Seat	Water pressure too high	Consider application limits	4
	Disc spring broken	Notify service point	

8.2 Other disruptions

Disturbance	Possible causes
Cutting head doop not open	Air pressure too low
Culling head does not open	Orifice clogged
	Water pressure above permissible operating pressure
Cutting bood doop not close	Broken disc spring
Cutting head does not close	Valve seat or needle damaged
	Foreign objects in the valve seat
Insufficient beem quality	Damage or contamination of the orifice
	Incorrect water pressure

9 Disposal

The cutting head consists exclusively of metal and plastic parts. All metal parts can be recycled. Dispose of the plastic parts properly in accordance with local regulations.