



**AUTOLINE II™ ABRASIVE CUTTING HEAD
*INSTALLATION AND MAINTENANCE PROCEDURES***



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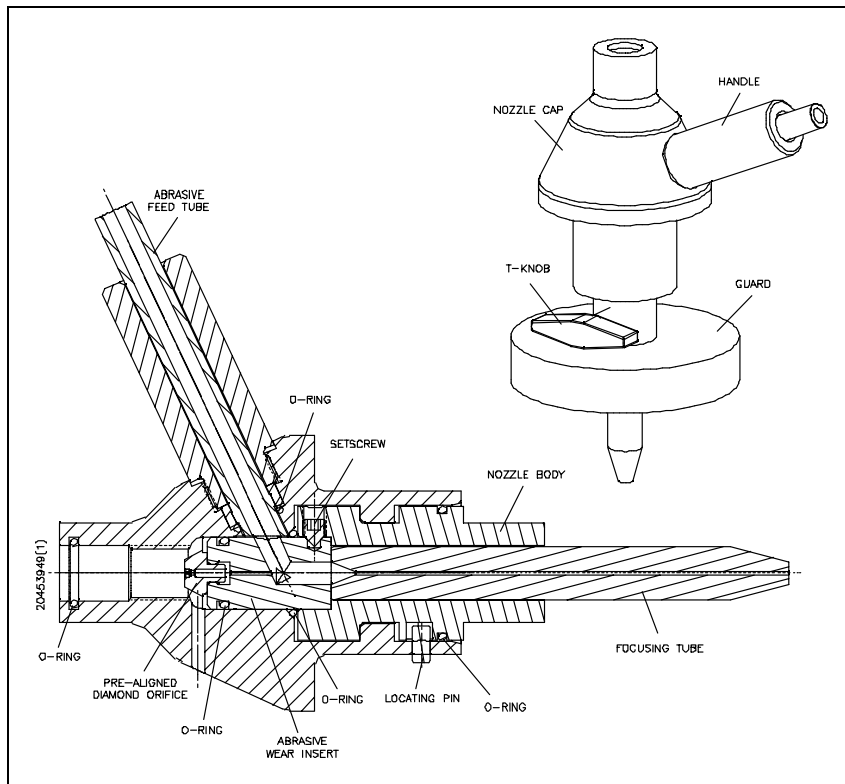
AUTOLINE II™ ABRASIVE CUTTING HEAD

INSTALLATION AND MAINTENANCE PROCEDURES

1. Overview

The Autoline II™ abrasive cutting head utilizes a quick connection mechanism and is designed to be assembled with only one Allen wrench to loosen the setscrew and remove the abrasive wear insert. It is the only cutting head in the industry with a precisely aligned diamond orifice. Every Autoline II™ diamond orifice is pre-aligned before it leaves the factory.

Figure 1: Autoline II™ Abrasive Nozzle



- The nozzle cap provides a quick connection between the nozzle tube and the nozzle body. The cap remains with the nozzle tube and includes an abrasive feed tube and handle.
- The removable nozzle body supports the abrasive wear insert, orifice and focusing tube.
- The diamond orifice converts high pressure water into a high velocity stream.
- The abrasive wear insert protects the body from excessive wear. Water and abrasive are first combined in the wear insert.



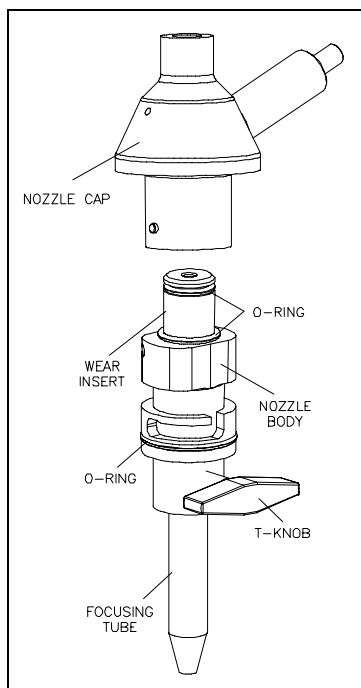
- The focusing tube entrains the abrasive into the waterjet and re-focuses the stream.
- The abrasive feed tube guides and connects the anti-static abrasive supply hose.
- The setscrew holds the wear insert in position.
- The T-knob holds and secures the focusing tube.

2. Installation

The Autoline II™ abrasive nozzle is shipped as a complete assembly. The orifice and focusing tube are packaged separately and require installation.

1. Install the focusing tube in the nozzle body. Push the tube until it bottoms out on the wear insert. Tighten the T-knob to secure the focusing tube.
2. Using the T-knob as a handle, rotate the removable body counter-clockwise 1/4 turn.
3. Slowly pull the body out of the nozzle cap.

Figure 2: Component Installation

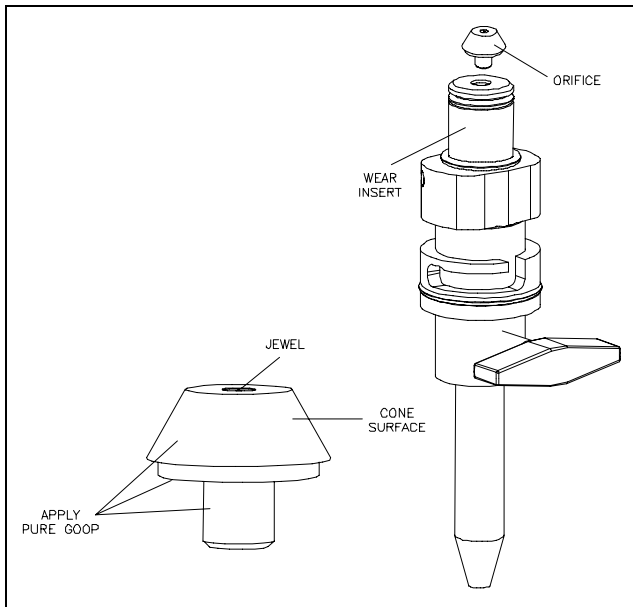


4. Apply FML-2 grease to the o-rings on the wear insert and the nozzle body. Clean the top of the wear insert where the orifice will be installed.
5. Apply a thin film of Pure Goop to all surfaces on the orifice except the top flat where the jewel is located. Mount the orifice in the hole on the top of the wear insert.

NOTE

Only KMT pre-aligned diamond orifices are recommended for use in the Autoline II™ nozzle assembly. Standard sapphire or diamond orifices are not aligned and will result in reduced cutting performance, asymmetric wear and reduced focusing tube life.

Figure 3: Orifice Installation



Using your fingers, press down lightly and rotate the orifice clockwise and counter-clockwise to evenly distribute the Pure Goop.



Failure to coat the contact surfaces of the orifice will result in damage to the orifice and/or mating components.

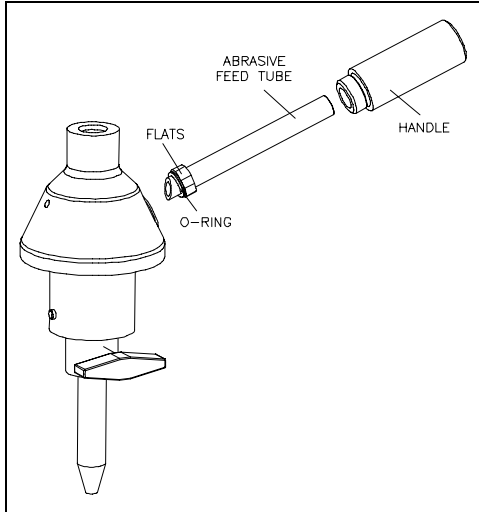
6. Align the machined slot in the body with the locating pin on the nozzle cap and insert the body into the cap. Push and rotate the body clockwise 1/4 turn to lock it in position.



The orifice sits loosely on the body. Make sure it remains in position during installation.

7. If necessary, install the abrasive feed tube in the nozzle cap, ensuring that the o-ring is installed on the feed tube and the flats on the feed tube align with the flats in the cap.

Figure 4: Abrasive Feed Tube Installation



8. Thread the handle into the cap until it bottoms out. Make sure it is tightly retained.



Failure to tighten the handle completely may result in loss of vacuum causing inefficient flow of abrasive into the wear insert.

9. Apply Pure Goop to the threads on the nozzle tube and thread the Autoline II™ assembly onto the nozzle tube. This is a left-handed thread. Hand-tighten only, the components will seal at 9 ft-lbs (12 Nm).



Over tightening can damage the cone surface of the orifice mount, the orifice and the seating area on the nozzle tube.

10. Push-connect the plastic, abrasive supply hose (not included) onto the abrasive feed tube.
11. If the hose and feed tube/handle are not aligned in the desired direction, loosen the gland on the pneumatic valve and rotate the nozzle tube and Autoline II™ assembly as one component to the desired location. Tighten the gland to 50 ft-lbs (68 Nm).



If the valve assembly is normally closed, air must be applied before the gland can be loosened or tightened. Failure to do so will result in damage to the valve stem and seat.

12. The Autoline II™ cutting head assembly can now be placed in service.

3. Service and Maintenance

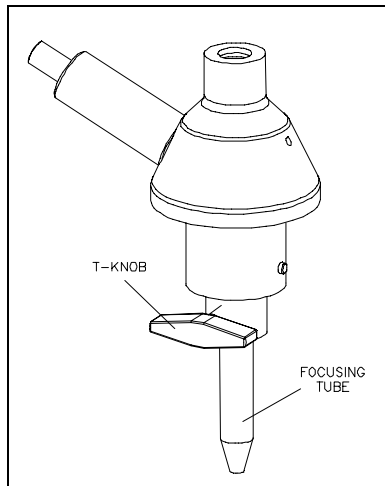
The following procedures are recommended for servicing the Autoline II™ cutting head assembly. Proper installation and maintenance will ensure the best cutting performance and longer operating life for all wear components.

Focusing Tube Replacement

Replacement frequency of the focusing tube depends on cutting quality requirements. To maintain productivity the bore diameter of the focusing tube should not be worn more than 30-40% of the original diameter. For example, if the original diameter is 0.030" (0.76 mm), the bore diameter must not exceed 0.042" (1.07 mm).

1. Loosen the T-knob and pull the focusing tube out. Use compressed air to remove any abrasives or water inside the nozzle body.
2. Install a new focusing tube into the nozzle body.
3. Push the focusing tube until it bottoms out on the wear insert. Lightly push the tube into the body with one hand, and hand-tighten the T-knob with the other hand. This will ensure the top face of the focusing tube is seated firmly against the bottom face of the wear insert.

Figure 5: Focusing Tube Replacement



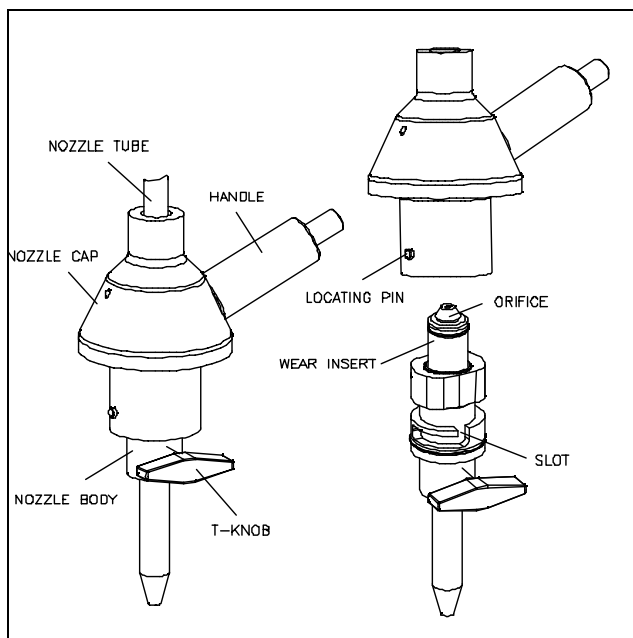
Diamond Orifice Replacement

If the abrasive water stream is inconsistent and ‘fanning’, either the focusing tube or the diamond orifice needs to be replaced; or the orifice needs to be cleaned with an ultra-sonic cleaning device.

Only KMT pre-aligned diamond orifices are recommended for use in the Autoline II™ nozzle assembly. Standard sapphire or diamond orifices are not aligned and will result in reduced cutting performance, asymmetric wear and reduced focusing tube life.

1. Using the handle, rotate the nozzle cap 1/2 turn or more to loosen the orifice from the nozzle tube seat. It may be necessary to remove the abrasive supply hose from the feed tube.

Figure 6: Diamond Orifice Replacement



2. Using the T-knob as a handle, rotate the removable body counter-clockwise 1/4 turn.
3. **Slowly** pull the body out of the nozzle cap and remove the orifice.



The orifice sits loosely on the top of the wear insert. Carefully remove the body to prevent the orifice from falling out. A small amount of Pure Goop applied to the orifice seat will minimize the risk of this occurring.

4. Clean any abrasive particles from the outside of the body. Apply a thin film of Pure Goop to all surfaces of a new orifice except the top flat surface where the jewel is located. Install the new orifice.



Failure to coat the contact surfaces of the orifice will result in damage to the orifice and/or mating components.

5. Align the machined slot in the body with the locating pin in the nozzle cap and insert the body into the nozzle cap.
6. Using the T-knob as a handle, rotate the body clockwise 1/4 turn.
7. Using the handle on the nozzle cap, hand-tighten the nozzle assembly onto the nozzle tube. **Hand-tighten only**, the components will seal at 9 ft-lbs (12 Nm).



Over tightening can damage the cone surface of the orifice mount, the orifice and the nozzle tube.

NOTE

If a new orifice and an old nozzle tube with a worn seating surface are used, much higher torque may be required to seal the components. If the components do not seal properly at the specified torque, replace the nozzle tube.

Wear Insert Replacement

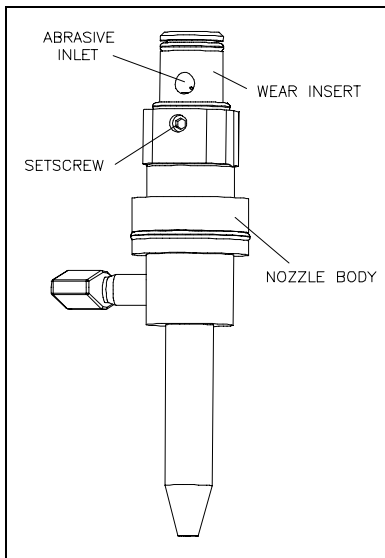
If the cutting performance is not satisfactory, or if the small jet-passage hole in the top of the abrasive wear insert enlarges to a star pattern, the wear insert needs to be replaced.

NOTE

A .030 (.763) wear insert should be used with 7/21, 10/30 and 12/36 nozzle assemblies. Nozzle assemblies 13/40 and 14/43, require a .043 (1.09) wear insert.

1. Follow Steps 1-3 in the procedure, Diamond Orifice Replacement.
2. Use an Allen wrench to loosen the setscrew in the body and remove the wear insert.

Figure 7: Wear Insert Replacement



3. Clean any abrasive particles from the nozzle body where the wear insert is seated. Failure to do so may cause improper seating of the insert, resulting in a misaligned jet.
4. Install a new wear insert ensuring the insert is properly aligned with the setscrew.
5. Tighten the setscrew to a maximum of 20 in-lbs (2.3 Nm).
6. Clean the top face of the new wear insert. Apply Pure Goop to all surfaces of the orifice except the top flat where the jewel is located. Install the orifice into the wear insert.



Failure to coat the contact surfaces of the orifice will result in damage to the orifice and/or mating surfaces.

7. Follow Steps 5-7 in the procedure Diamond Orifice Replacement.



4. Troubleshooting

The following troubleshooting guide will help identify the probable cause of a malfunction and assist in providing corrective action.

Troubleshooting Guide

	Malfunction	Comments
1.	Orifice drops out during nozzle body removal	Pull the body out very slowly, apply Pure Goop to all surfaces on the orifice except the top flat where the jewel is located and re-install.
2.	Orifice sticks tightly on the nozzle tube after removal	Sticking may be caused by over tightening the cutting head assembly. Hand-tighten only, 9 ft-lbs (12 Nm) maximum. Use your finger to apply some pressure on the stem of the orifice to loosen it from the nozzle tube. If it is too tight, use a small brass or aluminum rod to tap the orifice mount down to release it from the nozzle tube.
3.	Water leaks back into the abrasive supply hose when the high pressure water valve is on	<p>Check the focusing tube for blockage. If the focusing tube is plugged, isolate the abrasive supply from the cutting head, install the tube in the opposite direction and attempt to purge with high pressure water.</p> <p>Check for contaminates in the garnet that could plug the focusing tube.</p> <p>Check the garnet for moisture. If the garnet is wet, replace with dry garnet.</p> <p>Check the abrasive feed tube and supply hose for moisture. If the feed tube or hose is wet, air dry them, blow out the wet garnet and test again for leakage.</p> <p>Check for missing or fractured orifice.</p> <p>Check for dripping or leakage from the nozzle tube and/or from the focusing tube when the valve is closed. If leakage is observed, replace the valve stem and seat.</p> <p>Leaking water will wet the garnet and garnet entering the wear insert in clumps will plug the focusing tube resulting in water backing out from the abrasive feed tube.</p> <p>Use the handle to tighten the nozzle cap on the nozzle tube. If leakage is still observed from the weep hole, replace the nozzle tube. The cone seating surface may be worn or damaged.</p> <p>Check the distance between the focusing tube and the work piece standoff. Generally, the distance should be at least 0.050" (1.27 mm), especially for piercing operations.</p>



Troubleshooting Guide

	Malfunction	Comments
4.	Water leaks into the abrasive supply hose when the high pressure water valve is off	<p>Check for dripping or leakage from the nozzle tube and/or from the focusing tube when the valve is closed. If leakage is observed, replace the valve stem and seat.</p> <p>Leaking water will wet the garnet and garnet entering the wear insert in clumps will plug the focusing tube resulting in water backing out from the abrasive feed tube.</p>
5.	Abrasive water stream is bad, 'fanning'	<p>Inspect the orifice for damage. Any abrasive particles or metal chips can damage the orifice.</p> <p>Check the alignment by shutting the pump down with the high pressure water valve on. This will produce a fish line-like stream for the alignment inspection. Misalignment is characterized by the stream hitting the wall of the focusing tube when exiting the bore.</p> <p>If damage or misalignment is detected, replace the orifice with a pre-aligned, KMT diamond orifice only. Standard orifices, either sapphire or diamond are not aligned and will result in reduced life of the focusing tube.</p> <p>Ensure the bottom face of the orifice mount and top face of the wear insert is clear of grit or garnet that may cause the misalignment of the jet.</p> <p>Verify the top hole in the wear insert is the appropriate size for the orifice and focusing tube selected. Refer to procedure, Wear Insert Replacement. Using a smaller hole than specified will result in the stream hitting the walls of the hole at the center of the wear insert.</p> <p>A collision between the cutting head and the work piece may result in the deformation or permanent misalignment of critical components. Check alignment and replace damaged components if necessary.</p>



Troubleshooting Guide

	Malfunction	Comments
6.	Asymmetric wear on the outlet of the focusing tube	Verify the cutting head has been operating with pre-aligned, KMT diamond orifice. Standard orifices, either sapphire or diamond are not aligned and will result in reduced cutting performance and asymmetric wear, reducing the life of the focusing tube.
		Use of standard orifices, either sapphire or diamond are not aligned and will result in asymmetric wear. Indexing the focusing tube by 1/4 turn every 10 to 12 hours of operating time may optimize focusing tube life by evenly distributing the wear around the perimeter of the tube.
		Use of standard, non-aligned orifices may still result in a drastic reduction in the operating life of the wear insert.
		A serious collision in the cutting table may result in the deformation or permanent misalignment of critical components. Check alignment and replace damaged components if necessary.
7.	Focusing tube is clogged	Isolate the abrasive supply from the cutting head, install the focusing tube in the opposite direction and attempt to purge with high pressure water.
		Check the garnet for moisture. If the garnet is wet, replace with dry garnet.
		Check the abrasive feed tube and supply hose for moisture. If the feed tube or hose is wet, air dry them, blow out the wet garnet and test again for leakage.
		Verify the garnet size is appropriate for the focusing tube size.
		Check for contaminates in the garnet that could plug the focusing tube.
		Check for dripping or leakage from the nozzle tube and/or from the focusing tube when the valve is closed. If leakage is observed, replace the valve stem and seat.
		Leaking water will wet the garnet and garnet entering the wear insert in clumps will plug the focusing tube resulting in water backing out from the abrasive feed tube.



Troubleshooting Guide

	Malfunction	Comments
8.	Nozzle body will not pull out	<p>Loosen the nozzle cap 1/2 turn or more clockwise. Rotate the nozzle body 1/4 turn counter-clockwise to align the locating pin on the nozzle cap with the machined slot in the nozzle body. Wiggle and pull the body out. Inspect the o-rings and replace if necessary.</p> <p>Clean the abrasive from the nozzle cap and body before re-installing.</p>
9.	Significant loss in cutting speed	<p>Check the process settings; pressure, abrasive type and flow rate, orifice/focusing tube combination and material.</p> <p>Check the alignment and replace the orifice with a KMT pre-aligned diamond orifice if misalignment is observed.</p> <p>If the nozzle is used in a misaligned state for a prolonged time, the focusing tube may be damaged and require replacement.</p> <p>Check for vacuum loss. Vacuum loss can occur between the abrasive feed tube and the handle. Verify the handle is threaded tightly into the nozzle cap. Replace the o-ring on the feed tube if necessary.</p> <p>Ensure the nozzle body is fully rotated 1/4 turn and locked into the nozzle cap. If the abrasive feed tube and the abrasive inlet on the wear insert are not properly aligned, an adequate amount of abrasive will not enter the insert.</p> <p>Check the o-ring on the wear insert and replace if damage or wear are detected. A damaged o-ring will result in air being drawn in through the weep hole, resulting in vacuum loss.</p>
10.	Fracturing glass or other brittle materials when piercing	<p>Use a lower pressure for these applications, less than 20,000 psi (1,379 bar).</p> <p>When turning the jet on, program the ABRASIVE ON a half second preceding the WATER ON. When turning the jet off, program the WATER OFF a half second following the ABRASIVE OFF.</p>



Troubleshooting Guide

	Malfunction	Comments
11.	Cutting water is exiting the focusing tube; however, it is not cutting properly Cutting water is exiting the focusing tube; however, abrasive is not being drawn into the mixing chamber.	Ensure the abrasive feeder mechanism is working and feeding the correct amount of abrasive.
		Check the garnet for moisture. If the garnet is wet, replace with dry garnet.
		Check the abrasive feed tube and supply hose for moisture. If the feed tube or hose is wet, air dry them, blow out the wet garnet and test again for leakage.
		Ensure the nozzle body is fully rotated 1/4 turn and locked into the nozzle cap. If the abrasive feed tube and the abrasive inlet on the wear insert are not properly aligned, an adequate amount of abrasive will not enter the insert.
		Check the o-ring on the wear insert and replace if damage or wear are detected. A damaged o-ring will result in air being drawn in through the weep hole, resulting in vacuum loss.

5. Specifications

Table 1 provides specifications and torque values for the for the Autoline II™ abrasive nozzle assembly.

Table 1
Specifications

Maximum inlet high pressure water	60,000 psi (4,137 bar)
Weight, including focusing tube and guard	1.31 lb (596 g)
Torque Values	
Hand tight, maximum	10 ft-lbs (13.6 Nm)
Setscrew, maximum	20 in-lbs (2.3 Nm)



6. Parts List

This section contains a list of parts the Autoline II™ abrasive nozzle assembly. Assemblies are available in five standard diamond orifice/focusing tube configurations as detailed in Table 2. To facilitate the ordering of replacement parts, item numbers in each table correspond to the identifying numbers in the accompanying figures.

Use the following information to contact the Spare Parts Department at KMT Waterjet Systems.

USA

Customer Service Department
KMT Waterjet Systems
PO Box 231
Baxter Springs, KS 66713-0231

Phone (800) 826-9274
Fax (620) 856-2242
Email wj.parts@kmtgroup.com

Europe

Spare Parts Manager
KMT Waterjet Systems GmbH
Wasserstrahl Schneidetechnik
Auf der Laukert 11
D-61231 Bad Nauheim
Germany

Phone +49-6032-997-119
Fax +49-6032-997-271
Email order.spares@kmt-waterjet.com

**Table 2
Autoline II™ Abrasive Nozzle Assemblies**

Item	Part Number	Description	Quantity
	20454114	7/21 Assembly	
1	20453949	Autoline II™ Nozzle Assembly, .030 wear insert	1
2	05063847	Diamond Orifice, .007	1
3	10139426	Focusing Tube, .021 x 2.007	1
	20454117	10/30 Assembly	
1	20453949	Autoline II™ Nozzle Assembly, .030 wear insert	1
2	05077029	Diamond Orifice, .010	1
3	10126969	Focusing Tube, .030 x 3.125	1



Table 2
Autoline II™ Abrasive Nozzle Assemblies

Item	Part Number	Description	Quantity
	20454120	12/36 Assembly	
1	20453949	Autoline II™ Nozzle Assembly, .030 wear insert	1
2	05077300	Diamond Orifice, .012	1
3	05116652	Focusing Tube, .036 x 3.125	1
	20454123	13/40 Assembly	
1	20454108	Autoline II™ Nozzle Assembly, .043 wear insert	1
2	05136098	Diamond Orifice, .013	1
3	49835390	Focusing Tube, .040 x 3.125	1
	20454126	14/43 Assembly	
1	20454108	Autoline II™ Nozzle Assembly, .043 wear insert	1
2	05077037	Diamond Orifice, .014	1
3	10126928	Focusing Tube, .043 x 3.125	1

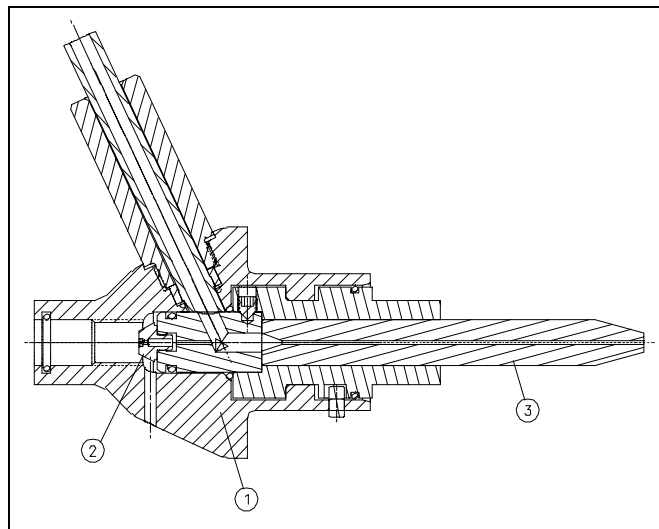


Table 3
Autoline II™ Nozzle Assembly
20453949/20454108

Item	Part Number	Description	Quantity
1	20453952	Nozzle Cap	1
2	20453958	Nozzle Body	1
3	20453064	Wear Insert, .030	1
	20453082	Wear Insert, .043	
4	20453964	Abrasive Feed Tube Assembly	1
5	20453973	Handle	1
6	20433398	Setscrew, 8-32	1
7	20453976	T-Knob	1
8	05138821	O-Ring, .69 x .81 x .06	1
9	20445476	O-Ring, .31 x .44 x .06	1
10	05087168	Guard	1
11	05081518	O-Ring, .38 x .50 x .06	1
12	05077078	O-Ring, .38 x .50 x .06	1
	49885361	Plastic Feed Hose	

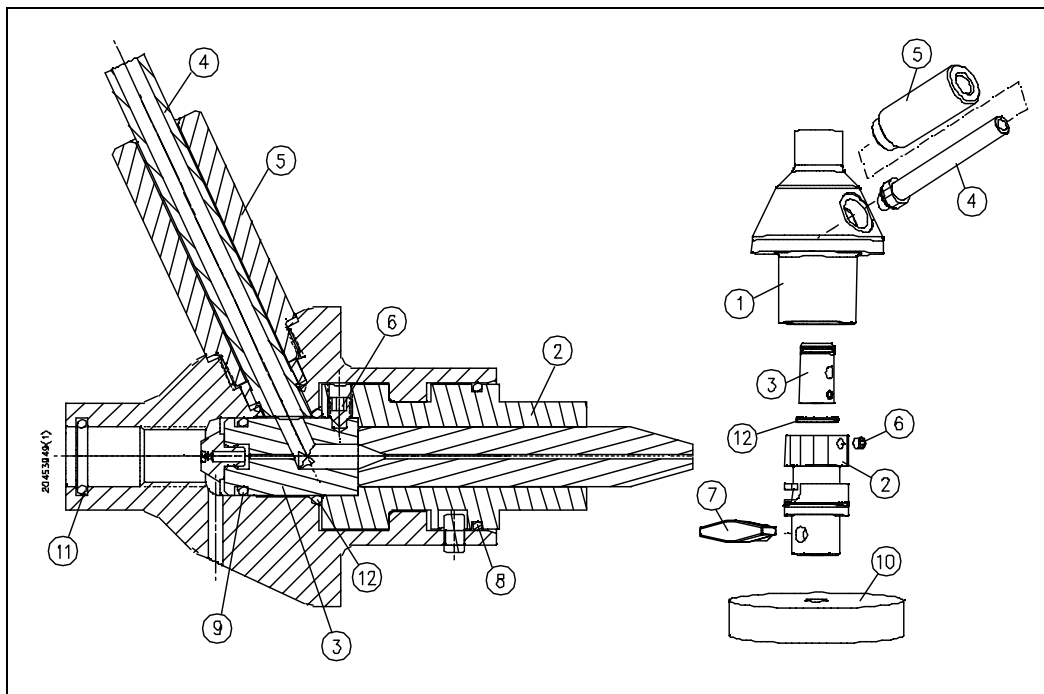




Table 3
Autoline II™ Nozzle Assembly
20453949/20454108

Item	Part Number	Description	Quantity
	20454129	Spare Parts Kit	
	20433398	Setscrew, 8-32	2
	05081518	O-Ring, .38 x .50 x .06	2
	20445476	O-Ring, .31 x .44 x .06	3
	05138821	O-Ring, .69 x .81 x .06	2
	05077078	O-Ring, .38 x .50 x .06	2