MKIV Coded Wire Tag Injector

Instruction Manual

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March 23, 2011
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1
INTRODUCTION

Northwest Marine Technology (NMT) designs and manufactures Coded Wire Tags, Injectors and Detectors. The decimal coded wire tag (DCWT) identification system provides an accurate and versatile method for assessing and researching both natural populations and hatchery reared animals. Coded Wire Tags have been implanted in hundreds of different marine and freshwater species. Reliability of the equipment and data allow for application in many areas of fisheries research and management.

The Model MKIV Tagging Unit is designed to give years of reliable performance. Please take time to read and understand the operating and maintenance instructions so you can obtain the maximum service from this product. Manuals for all NMT products can be downloaded at ***www.nmt.us/support/manual.htm***.

The MKIV Injector comes in various configurations:

1. MKIV Tag Injector only (a V-detector or Wand for quality control is recommended).
2. MKIV Tag Injector with a Quality Control Device (QCD)
3. MKIV Tag Injector with a T4 Detector (refer to the ***T4 Detector User's Manual)***
4. MKIV Tag Injector in an AutoFish trailer (refer to the ***AutoFish SCT Operator Manual)***.

Note: Model MKIV Tag Injectors and QCDs cannot be interchanged with earlier models MKI, MKII or MKIII equipment.

MKIV Tag Injector and QCD

MKIV in the AutoFish Trailer

The MKIV Tagging Unit is backed by a 1 year parts and labor warranty. NMT takes great pride in providing the best customer service and your complete satisfaction is important. Please contact us whenever you have questions or comments about our products.

2
ASSEMBLY AND SETUP

CONTENTS CHECKLIST

A MKIV Tag Injector is shipped with the following items in a transit case.

- MKIV Tag Injector
- Power Supply
- Touch Switch (or optional Foot Switch)
- 3 non-custom head molds
- 3,000 tag spool of test wire
- Tool Kit (components are shown in Appendix A)
- Instruction Manual

A MKIV Tagging Unit includes these additional items in a second transit case.

- Quality Control Device (QCD)
- Interconnect Cable
- Funnel
- Quick disconnect with a water filter

Make certain all the above items are present. Remove all items from the boxes and make sure nothing has been left in the packing materials.

ASSEMBLY

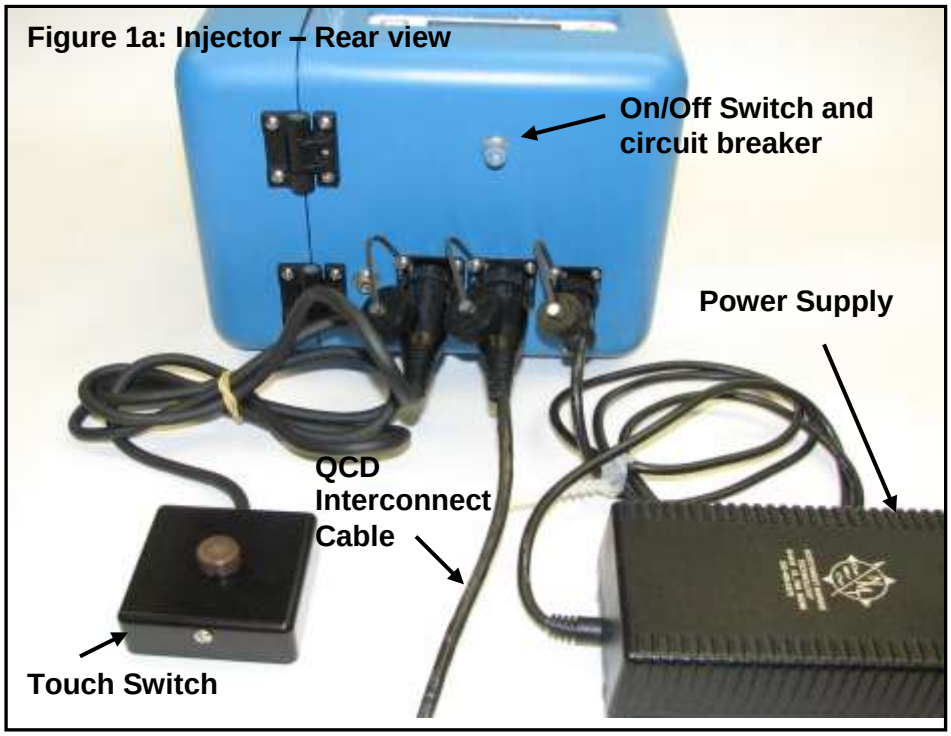
Place the Injector on a stable flat surface near the power source. The tagging equipment operates on 12-28 volts DC (approximately 50 watts). The Injector comes with a power supply which converts 110-240 volts AC to 24 volts DC. Plug the power supply into a grounded AC power outlet. If you have any uncertainty about whether the outlet is grounded, verify that the outlet is grounded before proceeding. Alternate DC power sources such as a 12 volt automobile battery can also be used when AC power is not available. Appropriate adapters for use with alternate power sources are available from NMT.

1) The Injector has a built-in circuit breaker (Figure 1) and protective fuse. If the circuit breaker is tripped the Injector will shut off. The circuit breaker will automatically reset after about one minute. If the circuit breaker does not reset, the internal protective fuse is most likely blown and the Injector must be returned to NMT for servicing.

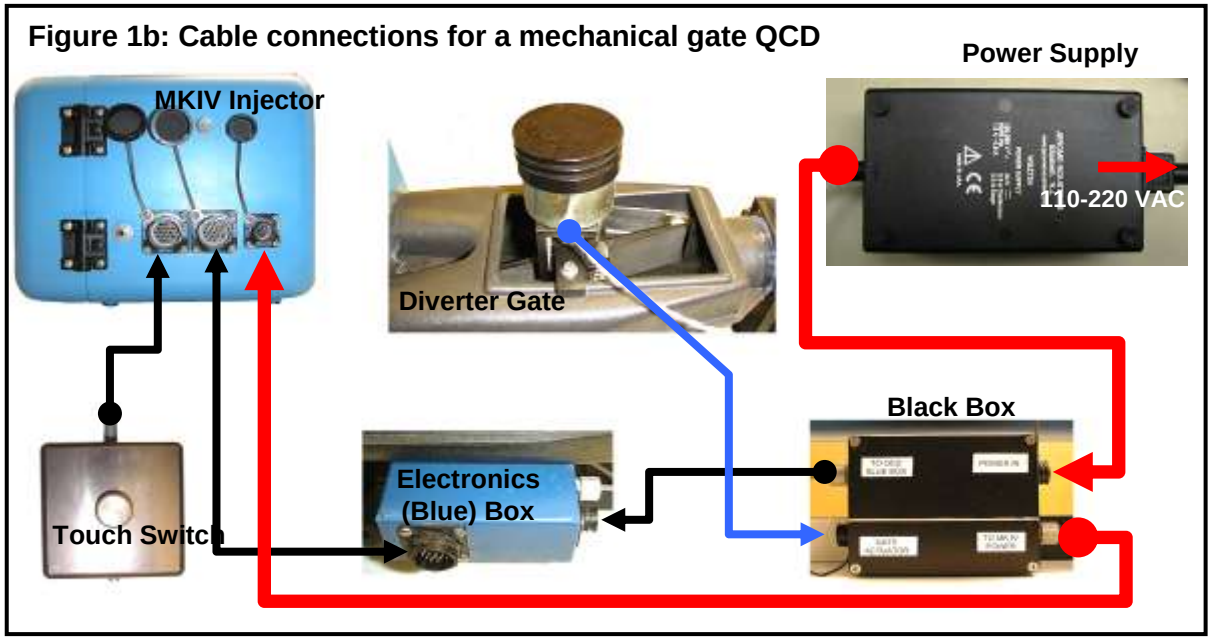
2) Connect the cable from the power supply to the 4 pin connector at the rear of the Injector (Figure 1).

3) The Touch Switch consists of a square metal block, push button and a cable (pg 42). Attach the cable to either of the two large connectors on the back of the Injector. Connect the QCD (if present) to the other large connector.

4) See page 26 for additional QCD assembly and setup if applicable.



Note: The two large connectors on the back of the Injector are interchangeable. Keep the protective caps closed on any unused connector(s).

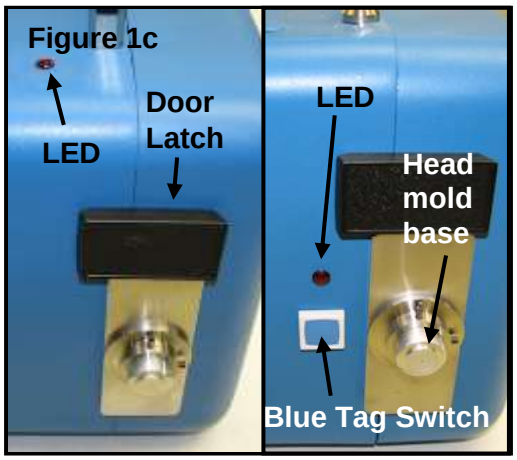


QUICK START

After the equipment is assembled follow these steps for initial testing and familiarization.

Note: These steps are intended to confirm that the equipment is operating and ready for the remaining adjustments. The completion of these steps does not mean that all steps necessary to start tagging have been completed.

1) Open the latch on the front of the Injector (Figure 1c) and swing the door open.



WARNING: DO NOT attach the QCD while the Injector is turned on or risk DAMAGING the internal electrical components!

2) Turn on system power by pressing the rubber-covered On/Off button on the back of the Injector (Figure 1a). When the Injector is turned on, a self-test sequence will take place and the display will show a "READY VX.X" message where “X.X” is the firmware version number. If a QCD is not connected, or if the self-test detects a problem with the QCD, the display will show the message "NO QCD OK?". If you see this message and the QCD is connected, check to make sure the QCD Interconnect Cable is properly installed. If you intend to operate without the QCD press any key on the keyboard to confirm this status and clear the message.

3) The Injector is shipped with a spool of test wire installed. If there is not a spool of wire on the machine, install one on the spool retainer before proceeding.

Note: The MKIV Injector ships with a 2.5 inch needle installed which is protected by a head mold base (Figure 1c). If a needle is not installed or a 3.5 inch needle is required, refer to pg 37 on how to properly install a needle.

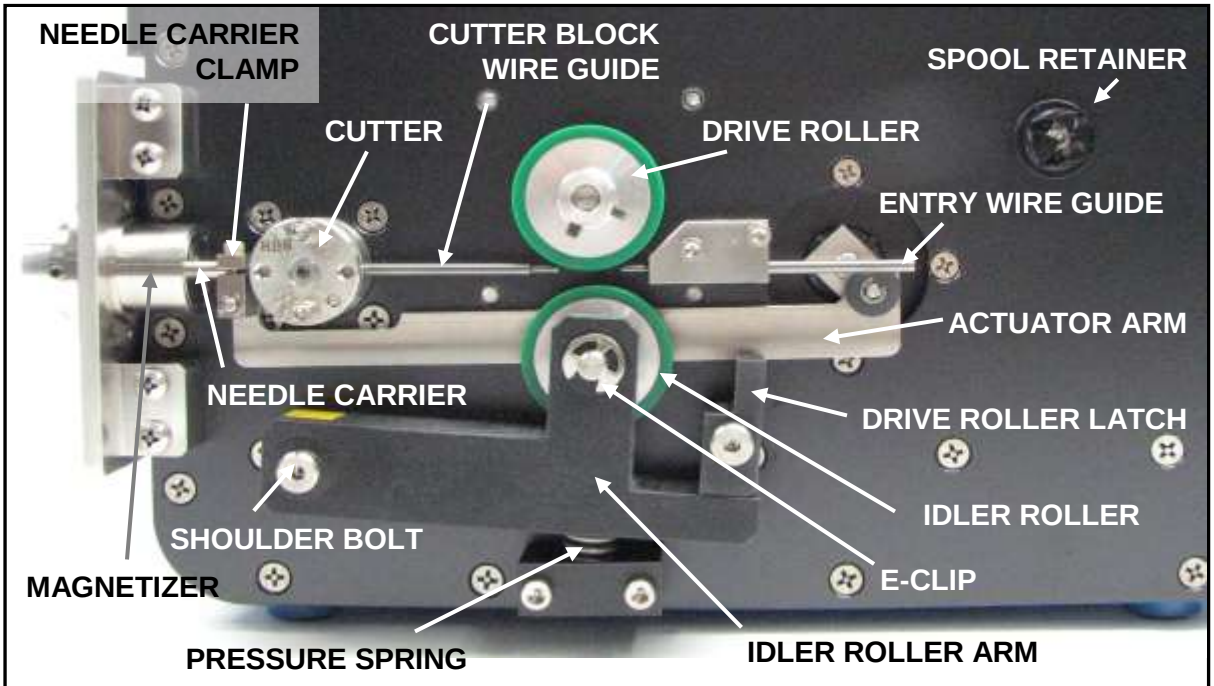


Figure 2: Injector Main-plate

4) Locate the idler roller arm and move the drive roller latch so that the rollers are engaged (Figure 2b).

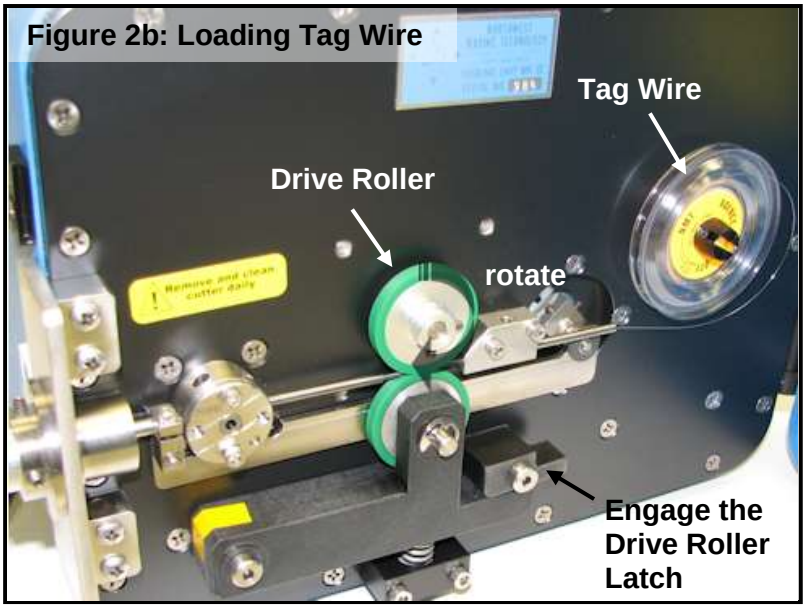


Figure 2b: Loading Tag Wire

5) Now load the tag-wire by pressing [LOAD] (pg. 15) on the keyboard. The display will show the message “LOAD 100" and the drive rollers can be rotated easily by hand. The Injector may make a hissing sound when in the LOAD position. This is normal.

6) Insert the tag-wire into the entry wire guide and push it forward until it reaches the drive rollers. Rotate the top roller clockwise by hand to feed the wire into the cutter block wire guide (Figure 2b). Continue turning the top roller until the tag wire extends slightly beyond the tip of the needle.

7) Press the [OK] key. The Injector will retract and cut the tag wire. Cycle the Injector once by pressing either the Touch Switch button, the [TAG] key, or the blue tag switch on the front of the Injector if equipped (Figure 1c). Any of these three switches will cycle the Injector. The first piece of wire ejected will be longer than a standard tag. Cycle the Injector a few more times to see how it operates and confirm the Injector is making the proper length tags. Each cycle will produce one tag. If a QCD is attached, the red error light and tone will be activated as determined by the *Tag Credit* value (pg. 24). This indicates that tagged specimens are not being detected by the QCD, and is normal for this sequence.

3
GETTING READY TO TAG

Before tagging, please read ***NMT's Coded Wire Tag Project Guide*** included with your MKIV Tag Injector or downloaded from *www.nmt.us*. It provides a comprehensive overview of coded wire tagging projects and discusses appropriate setups for a variety of species and environments.

The following MKIV Tag Injector adjustments need to be made or checked before tagging:

- Needle selection
- Positioning jig selection (for example a head mold)
- Tag length (pg 19)
- Common Menu Settings
- Needle penetration
- Tag placement depth

If you are using a Quality Control Device (QCD) you will also check or adjust:

- Water flow (both versions) (pg. 26)
- Separator jets (water jet version only) (pg. 30)
- Mechanical gate (mechanical gate version only) (pg. 28)
- QCD delay (pg. 23)
- QCD Threshold (pg. 20)

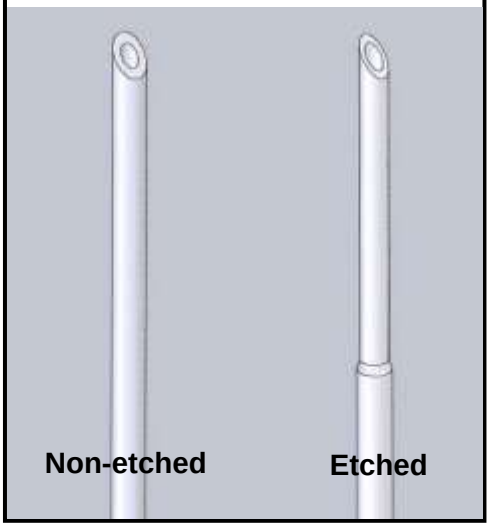
NEEDLE SELECTION

Four needle styles are offered for the MKIV Tag Injector:

- 2.5 inch (63.5 mm) etched or non-etched
- 3.5 inch (89 mm) etched or non-etched

Non-etched needles do not have a reduced outside diameter near their tip, making them better suited for larger animals or tagging into harder locations because of their added strength. Etched needles have a reduced outside diameter near the tip, making them better suited for smaller animals, where a smaller incision is required or for tagging into soft tissue. The trade off with etched needles is reduced strength in the tip.

Figure 3: Needle styles



NEEDLE POSITIONING JIG SELECTION

The most common type of positioning jig used with a MKIV Tag Injector is the head mold. NMT sells head molds for a wide variety of size and species fish (see Table 1). A custom head-mold kit is also available from NMT to allow the end user to create unique head molds.

Species	Head Mold Size (fish/lb); *CMS=Closed Mouth Style*
coho/Chinook	5, 10, 15, 20, 30, 45, 65, 90, 120, 200, 300 (*CMS*), 550, 1100
Steelhead (Rainbow)	2(5), 3(8), 5(12), 7(18), 11(27), 20(50), 36(90), 80(200)
Pink	2000 (*CMS*)
Atlantic Salmon	7, 9, 11, 15, 25, 30, 50, 100, 120
Lake Trout	5, 8, 12, 18, 27, 50, 90
Chum	700
Species	**Head Mold Size (length in mm); *CMS=Closed Mouth Style***
Sockeye	60 (*CMS*), 90
Walleye	55, 65, 125
Mullet	60-70, 70-80, 100, 120, 140
Paddlefish	Not Size designated but for approx. a 6 inch fish

Table 1: NMT head mold sizes

In some cases tagging is performed without the use of a positioning fixture. Many fishes, crustaceans and other animals may have tagging sites which do not require, or are not conducive to, the use of a positioning jig. The operator would manually impale the specimen on a non-moving needle (see *Item: Needle Move* pg. 22) and then inject the tag. In these instances it is still desirable to have some depth control so that the operator knows how much of the needle has penetrated the specimen. The needle support tube (supplied in the tool kit) makes a good depth stop.

Figure 4a: Positioning Jigs

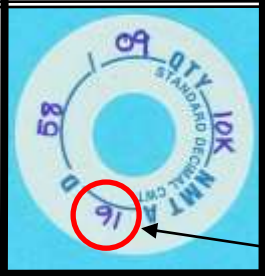
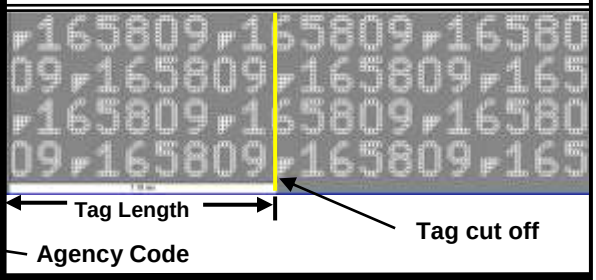
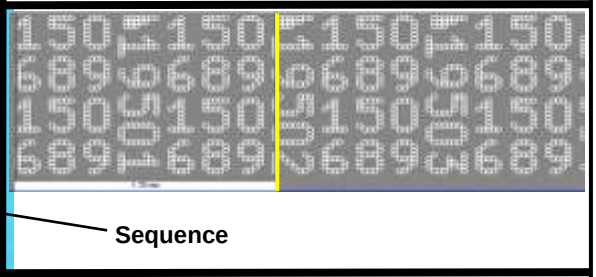
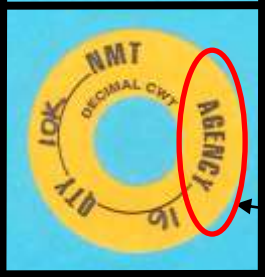
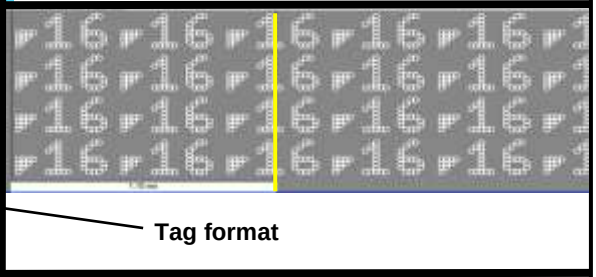
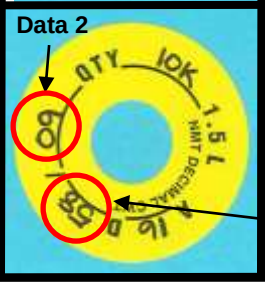
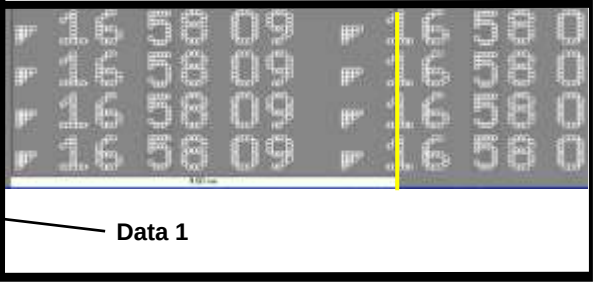
TAG LENGTH

WARNING: If the tag length of the MKIV Tag Injector is set to cut tags SHORTER than that specified on the spool, then the tags' code(s) will be unreadable (see Table 2).

There are two ways to set the tag length of the Injector:

1) Under the *Setup* option (pg. 19) in the Adjustment menu (ADJ), select *Standard* (otherwise known as single length tags), *Half, 1 ½,* or *Double*.

Table 2: Coded Wire Tag formats

DCWT Format and MKIV Injector setting	Spool Label	**Layout:** If a 2 mm piece of wire were unrolled and magnified, it would look like this. The yellow bars show where tags of each format would be cut by the MKIV Tag Injector.
Standard DCWT: TAG LEN [SGL] (pg 19) **or** SETUP [STANDARD] (pg 19)		
Sequential DCWT: TAG LEN [SGL] **or** SETUP [STANDARD]		
Agency DCWT: TAG LEN [SGL] **or** SETUP [STANDARD]		
½ Length DCWT: TAG LEN[1/2] (pg 19) **or** SETUP[HALF] (pg 19)		
1 ½ Length DCWT: TAG LEN[1 1/2] (pg 19) **or** SETUP[1 1/2] (pg 19)		

2) Choose the appropriate tag length in the Adjustment menu under the option *TagLength* (pg. 19).

Note: Using the *TagLength* option will automatically display *Special* if other options, for example *Needle Move*, are changed in the Adjustment menu. One can also store 2 different adjustment settings using *Custom1* and *Custom2* (pg. 19).

COMMON MENU SETTTINGS

1) **Using a head mold and 2.5 inch needle:**
    - Setup [STANDARD/HALF/1 1/2] (pg 19)
    - Show [96] (pg 15)

2) **Using a needle support tube and a 3.5 inch needle:**
    - Setup [SPECIAL/CUSTOM 1/CUSTOM 2]
    - Needle Move [NO] (pg 22)
    - Stop [1] (pg 21)
    - Show [171]

3) ***Using a needle support tube and a 3.5 inch needle:**
    - Setup [SPECIAL/CUSTOM 1/CUSTOM 2]
    - Needle Move [S5-S23]
    - Stop [2], *the needle starts in the extended position.*
    - Min. Time [0-255] (pg 22)
    - Show [172-180] , *dependant on the amount of Needle Move.*

    *This setup using Stop 2 and a small amount of Needle Move is recommended over no Needle Move (common setup 2) and a Stop of 1 if poor tag retention is an issue.

NEEDLE PENETRATION

Needle penetration refers to the depth the needle will penetrate into the specimen. Proper penetration depth is very important for tag retention and depends on the size and species of the specimen being tagged. Penetration depth is controlled with the use of a headmold or positioning jig.

To set the needle penetration depth, put the Injector in the SHOW mode which will move the needle to its fully extended position. Loosen the set screws in the head-mold holder and slide the appropriate head mold/needle positioning jig in or out to adjust the distance the needle will extend into the specimen. Gently tighten the set screws to hold the head mold in place.

TAG PLACEMENT DEPTH

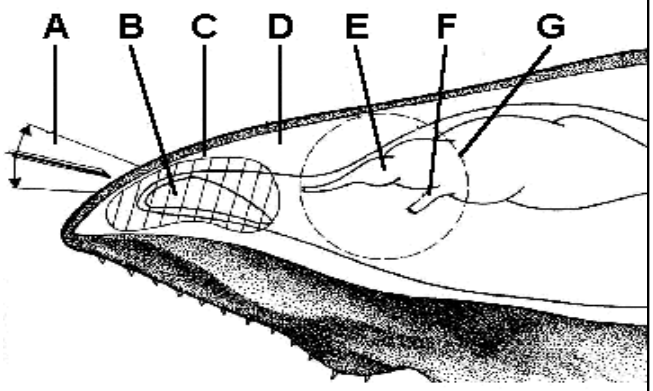
Tag placement depth refers to the position of the tag with respect to the tip of the needle. Tag placement depth can be estimated by measuring the distance from the end of the wire to the surface of the head mold while the Injector is in *SHOW* mode (pg. 15). In all cases correct tag placement depth must be confirmed by dissection of tagged test specimens. Figure 4b shows the preferred placement for DCWT in salmonids.

Note: In the *SHOW* mode, the tip of the uncut tag wire will move to the same position as the leading end of the tag at implantation. Thus, the end of the uncut tag wire represents the tag's deepest point of penetration.

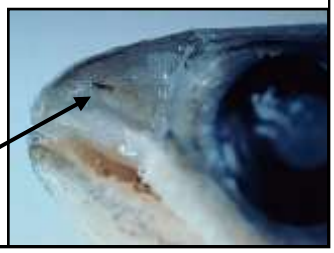
There are instances when the tag must be extended beyond the tip of the needle, and other cases when the tag should not be extended beyond the tip of the needle. Examples of these cases are given below.

Tag placement depth beyond the tip of the needle: There are instances when you may wish to manually impale the specimen on a non-moving needle. This technique can be used when the tag implantation site does not lend itself to the use of a head mold or positioning fixture. Since the needle will not be retracting to leave the tag in the specimen, the tag implantation depth must be modified using the SHOW function so that the tag is delivered beyond the tip of the needle. Otherwise the tag will not reach the tip of the needle until additional tags from subsequent Injector cycles force it out. The approximate SHOW value using a standard length needle with "NEEDLE MOVe (NO)" is 78.

Figure 4b: Typical Tag Placement - Salmonid



A - Usual range of tagging needle angles
B - Muscle, adipose and fibrous tissue
C - Tag target area
D - Cartilage
E - Olfactory lobe and nerve
F - Optic nerve
G - Position of eye



Tag placement depth behind the tip of the needle: Whenever the target area is very hard (e.g., the head of steelhead trout), trying to inject the tag into tissue which has not been penetrated by the needle itself will cause a wire jam or slippage of the drive rollers. In this case use a tag placement depth which does not extend any part of the tag beyond the tip of the needle. This way the needle can penetrate the hard tissue and, upon retracting, leave the tag in a previously penetrated area.

Proper tag placement must be verified by dissection of the tagged specimens. Please refer to the *Coded Wire Tag Project Manual* for more details about ensuring correct tag placement.

FINAL CHECK

As a review, see that the following items have been considered and checked before tagging begins.

- Proper spool of wire is loaded (pg 6) .
- Tag length set to correspond to tag format (pg. 19).
- Tag target chosen for specimen.
- Head mold or positioning fixture and injection technique determined.
- Needle penetration and tag placement depth set and tested.
- QCD water flow and mechanical gate (or jet position) adjusted (pg. 25).

4
CONFIGURATION

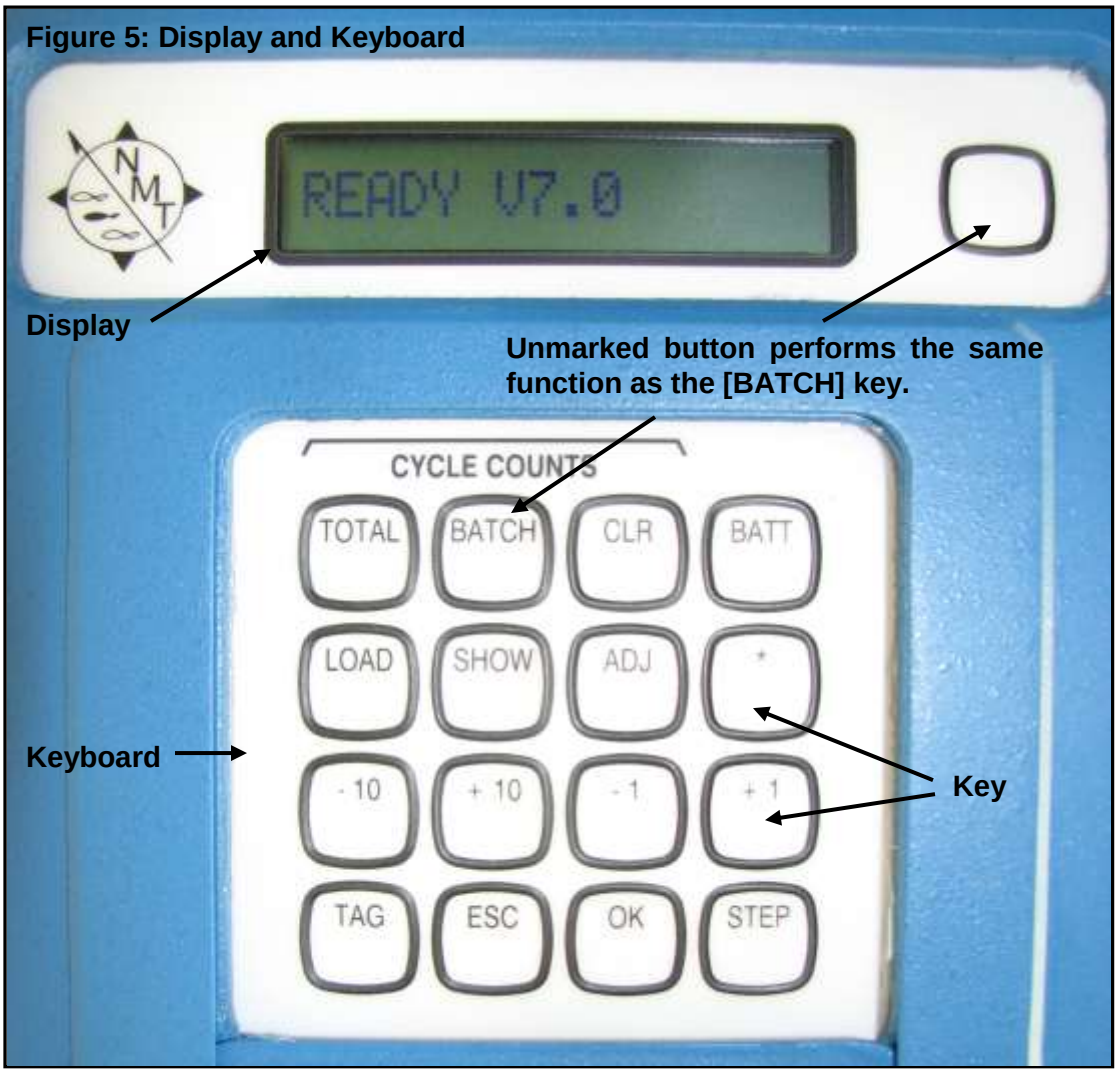
KEYBOARD

The keyboard on top of the Injector is used to make nearly all operating adjustments and to obtain system information. All items displayed when using the keyboard are kept in circular lists. This means that as you proceed through the choices, after the last item is displayed the first item is displayed again. This section describes each key, its function and corresponding displays/options.

Explanations of the keyboard and its functions use the following conventions:

[ ] Names of keys are shown in square brackets.
" " Display messages are shown in quotes.
( ) Changeable values are shown in parentheses.

Figure 5: Display and Keyboard



Key: [TOTAL]

Purpose:
To display the non-resettable counts of Injector cycles and QCD activations. These counts are retained even with the power off for the life of the Injector. Non-resettable counts are useful for keeping a maintenance record on items such as cutters, drive rollers and needles.

Operation:
Press **[TOTAL]** -- toggles between "T INJ x" and "T QCD x" where x is the total Injector cycles or QCD activations, respectively.

Key: [BATCH]

Purpose:
To display the resettable counts of Injector cycles, QCD activations, and the net difference, called rejects, between the two. Batch may be used to keep track of items such as activity per hour, day, group, etc. There is an unlabeled key next to the display which functions identically to the [BATCH] key, and can be used with the keyboard cover closed. To reset the batch counts see the explanation for the [CLEAR] key.

Operation:
Press [**BATCH]** -- displays "INJ x", x = the number of Injector cycles.
Press **[BATCH]** -- displays "QCD x", x = the number of QCD activations.
Press **[BATCH]** -- displays "REJ x" , x = the number of rejects ("INJ x" – "QCD x").

Key: [CLeaR]

Purpose:
To reset all of the batch counts to zero. The CLEAR function only operates when the BATCH counts are displayed.

Operation:
Press **[BATCH]** -- displays the batch counts.
Press **[CLEAR]** -- displays "OK TO CLR CNTS?"
Press **[OK]** -- clears the batch counts **or**
Press **[ESC]** -- cancel clearing the counts

Note: Pressing **[OK]** to affirm a choice or pressing **[ESC]** to decline is common throughout the MKIV menu system.

Key: [BATT]

Purpose:
Short for "battery". Pressing this key displays the approximate DC input voltage at the Injector. This function can be used to monitor the performance of the power source. Input voltage should be between 12 and 28 VDC when the tagging unit is idle.

Operation:
Press **[BATT]** -- displays 'BATT XX.X" which is the input voltage.

Note: If the voltage drops below 11.5 Volts a “POWER LOW” error message will appear.

Key: [LOAD]

Purpose:
To set the Injector into position for loading tag wire and installing the needle carrier, actuator arm or needle. Pressing **[LOAD]** aligns the cutter, retracts the actuator arm and releases the drive rollers so they can be turned by hand. The Injector may make a hissing sound when in the *LOAD* mode. This is normal.

Operation:
Press **[LOAD]** -- displays "LOAD 100" and the Injector is ready for loading tag wire or installing the needle carrier and needle. The value 100 represents cutter position and is ordinarily of no interest to the operator.
Press **[ESC]** -- exits the *LOAD* mode without moving the tag wire, or
Press **[OK]** -- exits the *LOAD* mode, retracts and cuts the tag wire to prepare for the start of tagging

When **[OK]** is used to exit the *LOAD* mode, the Injector assumes the wire is extended to the tip of the needle and retracts and cuts the tag wire. The Injector must be cycled once by pressing the **[TAG]** key to eject the first piece of wire because it is larger than a normal tag.

When **[ESC]** is used to exit the *LOAD* mode, the Injector assumes the position of the tag wire should not be changed and so the tag wire is not moved. A common use for using **[ESC]** instead of **[OK]** to exit *LOAD* is when installing a new needle/needle carrier in an Injector with wire already loaded.

IMPORTANT: Using **[OK]** to exit the *LOAD* mode if the wire is not at the tip of the needle will cause the wire to retract too far resulting in a “NO WIRE OR STUCK” message.

Key: [SHOW]

Purpose:
To allow the operator to set the position of the tag with respect to the tip of the injection needle. In the *SHOW* mode, the tip of the uncut tag wire will move to the same position as the leading end of the tag during injection. Thus, the end of the uncut tag wire represents the tag's deepest point of penetration.

Operation:
Press **[SHOW]** -- displays "SHOW (XX)" and the Injector cycles to extend the tag wire to represent the tag's deepest point of penetration.
Press **[OK]** -- opens the brackets on the value
Press **[+1]/[-1]** -- increases or decreases the tag placement depth 1 unit. Use **[+ 10]** or **[-10]** for 10 units.1 unit equals 0.01 inches (0.25 mm).

Press **[OK]/[ESC]** -- saves or discards new SHOW value respectively.
Press **[ESC]** -- if pressed after [OK] exits the SHOW mode

Extra:
While in the *SHOW* mode the **[TAG]** and **[STEP]** keys can be used to activate the QCD so that the mechanical gate or water jets in the separator can be observed and/or adjusted. Pressing **[TAG]** activates the actuator or solenoid one time by turning it on and off. Pressing **[STEP]** toggles the actuator or solenoid between on and off.

Key: [*]

Purpose:
To clear serious error messages before resuming operation of the Injector. Also used to store settings for CUSTOM 1 and CUSTOM 2 (see pg. 19).

Key: [-10], [+10], [-1], [+1]

Purpose:
To select different menu options and to set values for operating parameters. Press [+1] or [-1], [+10] or [-10] to change values either one or ten units at a time. Use [+1] or [-1] to select different menu options and make small changes in numerical values. Use [+10] or [-10] to make large changes to numerical values.

Key: [TAG]

Purpose:
1) Pressing **[TAG]** cycles the Injector when the Injector is on and not in either *SHOW* or *LOAD* mode, You can also cycle the Injector by pressing a Touch Switch, Foot Switch, or the blue button on the front of the Injector******.

2) Pressing **[TAG]** causes the QCD actuator or solenoid to activate as if a tagged specimen had been detected when the Injector is in the SHOW mode. For more information refer to the section explaining the **[SHOW]** key (pg. 15).

****** Not available on an AFS style MKIV Injector.

Key: [ESC]

Purpose:
Short for “escape”:
1) Pressing **[ESC]** reapplies the brackets and reinstates the previously stored value when making changes to a menu item.

2) When a menu item or value is displayed with the brackets in place, pressing [**ESC]** will return the Injector to the READY to tag mode.

Key: [OK]

Purpose:
To store a menu choice or value selected by the operator, or to instruct the Injector to proceed. The effect of the **[OK]** key differs slightly depending upon when it is used.

Operation:
1) Using the **[OK]** key to clear batch counts:
   Press **[CLEAR]** -- displays "OK TO CLR CNTS?"
   Press **[OK]** -- clears the batch counts.

2) Using the **[OK]** key to exit the *LOAD* mode:
   Press **[LOAD]** -- displays "LOAD 100" and the Injector is ready for loading tag wire or installing the needle carrier and/or needle.
   Press **[OK]** -- exits the LOAD mode, retracts the tag wire 6.5cm and cuts the wire.

3) Using the **[OK]** key to select menu items:
   Press **[ADJ]** -- displays menu choices.
   Press [**+1]/[-1]** -- to select menu item.
   Press **[OK]** -- removes brackets from item.
   Press **[+1]/[-1]** -- to change item or value.
   Press **[OK]** -- restores brackets and stores new value.

Key: [STEP]

Purpose:
1) To execute one at a time, in sequence, the steps which comprise a complete injection cycle.
2) Also **[STEP]** is used to activate and deactivate the QCD actuator or solenoid when the Injector is in the SHOW mode. This is useful in adjusting the mechanical gate or water jets.

Operation:
1) Each time the **[STEP]** key is pressed the Injector will proceed to the next step in the tag injection cycle. The **[STEP]** key can be used to observe which action takes place at each point and for diagnostic purposes. If you wish to exit the STEP mode at any time, press **[TAG]**.

2) The **[STEP]** key can also be used to activate and deactivate the QCD actuator or solenoid when the Injector is in the SHOW mode.
   Press **[SHOW]** -- displays "SHOW [XX]"
   Press **[STEP]** -- turns the QCD solenoid on and holds it on.
   Press **[STEP]** -- turns the QCD solenoid off.
   Press **[ESC]** -- exits the SHOW mode.

ADJUSTMENT MENU

 *Key: [ADJ]*

Purpose:
Short for “adjust”. To view and adjust a number of operating parameters for the MKIV Tag Injector. The procedure for viewing, selecting and storing values is the same for all items, and is described here.

Each menu item is initially displayed as a caption at the left of the display, and a description or value in brackets at the right.

Items in the adjustment menu are:
- SETUP (pg.19)
- TAG LENgth (pg.19)
- WIRE (pg.20)
- QCD THRESHold (pg.20)
- STOP (pg.21)
- NEEDLE MOVe (pg.22)
- MIN. TIME (pg.22)
- QCD BEEP (pg.23)
- QCD DELAY (pg.23)
- CUT EDGE (pg.23)
- TAG CREDIT (pg.24)
- US-EUR (pg.24)

Operation:
Press **[ADJ]** ..... displays "SETUP (STANDARD)"

The brackets signify that the item is closed and the value cannot yet be changed. Press **[+1]** to move one menu item down the list, **[-1]** to move one menu item up the list. Once the desired menu item is found, press **[OK]** to remove the brackets and open the item. With the brackets removed the item can now be changed. Press **[+1]**,**[-1]**,**[+10]**, or **[-10]** to select alternative operating parameters or values.

After changing the item’s parameter, press **[OK]** or **[ESC]** to save or discard the changes respectively. When all adjustments have been made and you want to exit the *ADJustment* menu press **[ESC]**.

Example:
Press **[ADJ]** -- displays "SETUP (STANDARD)"
Press **[-1]** -- displays "US-EUR (X,XXX.X)"
Press **[-1]** -- displays "TAG CREDIT (X)"
Press **[-1]** -- displays "CUT EDGE (1)"
Press **[OK]** -- displays "CUT EDGE 1" Brackets removed, item open.
Press **[+1]** -- displays "CUT EDGE 2"
Press **[OK]** -- displays "CUT EDGE (2)" Brackets restored, new value saved **OR**
Press **[ESC]** -- displays “CUT EDGE (1)” brackets restored, old value restored
Press **[ESC]** -- exits the *ADJust*ment menu

The items available in the *ADJustment* menu follow.

Item: SETUP

Options:
STANDARD, 1½, DOUBLE, CUSTOM 1, CUSTOM 2, SPECIAL, HALF EZ, HALF.

Purpose:
This item selects a pre-defined set of operating parameters, or to set and save a customized set of operating parameters. Selecting one of these setups, except SPECIAL, will assign new values to TAG LENgth, WIRE, QCD THRESHold, STOP, NEEDLE MOVe and MIN. TIME. An * is displayed to the left of these menu items as a reminder that they are changed when selecting a different SETUP option.

Note: Selecting a different SETUP does not change the settings for QCD BEEP, QCD DELAY, CUT EDGE, TAG CREDIT and US-EUR.

STANDARD, 1½, DOUBLE, HALF EZ, HALF:
If the operator selects one of these pre-defined setups then TAG LENgth, WIRE, QCD THRESHold, NEEDLE MOVe and MIN. TIME are automatically set to the values shown in Appendix C (pg. 51).

CUSTOM 1, CUSTOM 2:
To select and save a set of personalized parameters use CUSTOM 1 and CUSTOM 2. As delivered from the factory, CUSTOM 1 and CUSTOM 2 are set the same as STANDARD, but they may be redefined by the operator. To define a custom setup:

1) Set the desired values for each of the operating parameters which are controlled by the SETUP function (those items which have a * to the left on the display).

2) Select the SETUP menu item, press **[OK]** to open it, and use **[+1]** or **[-1]** to choose CUSTOM 1.

3) Press the **[*]** key. The display will then show "NEW CUSTOM 1?"

4) Press **[OK]** to save the current adjustment values as CUSTOM 1. CUSTOM 2 is a separate and independent setup used in the same way.

SPECIAL:
Any change made to the *ADJustment* menu items used by the predefined setups, without using the predefined setups, will automatically show as “SETUP(SPECIAL)”.

Item: TAG LENgth

Options:
1/2, SGL, 1 ½, DBL

Purpose:
This item sets the tag length. A standard/single (“SGL”) length tag is 1.1 mm (0.042 in) long. All other tags lengths are described with respect to a standard tag. Thus, a ½ length tag is 0.5 mm (0.021 in) long and a 1 ½ length tag is 1.7 mm (0.063 in) long. Which length of tag to use is based primarily on specimen size, tag code format, and recovery detection method. The standard (SGL) length tag is suitable for most applications. Longer tags are easier to read and easier to detect magnetically, but may

be too large for small specimens. HALF tags, which are used in the smallest specimens, are not as easy to detect and not all coding formats (e.g. sequential) are available in the half length format.

WARNING! If the tag length of the MKIV Injector is set to cut tags SHORTER than the format specified on the spool, then the tag code will be unreadable.

Item: WIRE

Options:
NORMAL, EZ-FIND, NON STD, MAG OFF

Purpose:
This item controls the electronic magnetizer. This item should **ALWAYS** be set to **NORMAL** while tagging. The EZ-FIND and NON STD options are reserved for future use. The MAG OFF option turns off the electronic magnetizer and is not recommended.

WARNING! If you turn off the magnetizer the tags will NOT be electronically detectable in the specimen.

Item: QCD THRESHold

Options:
0 through 255

Purpose:
This item sets the detection sensitivity of the Quality Control Device (QCD). The lower the value, the smaller the magnetic signal required to activate the QCD. Since a half-length tag generates a smaller magnetic signal than a standard or longer tag, a lower THRESHOLD value is necessary to detect half-length tags.

Tip: When setting THRESHOLD it is not necessary to have the brackets closed while trying out different values. The value which is displayed is currently active. Remember to restore the brackets by pressing OK to retain any changes you make or press ESC to discard any changes you have made.

Setting the THRESHOLD too high will result in the tags not being detected. Setting the THRESHOLD too low may cause the QCD to be falsely activated by substandard tags or by external sources of magnetic interference. The default factory QCD threshold setting is 50 for a standard length tag and 20 for a half-length tag. Tags in the transverse orientation are harder for the QCD to detect. In this case a threshold of 15-20 is recommended for standard length tags in a transverse orientation.

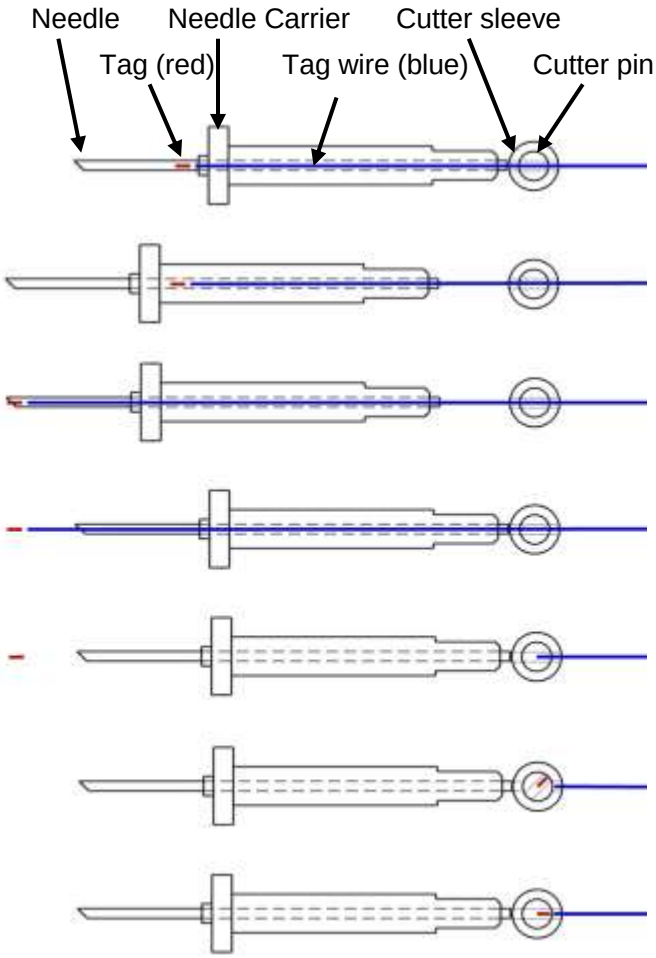
Note: It is not recommended that the QCD be operated at maximum sensitivity (i.e. a low QCD Threshold) as doing so may pass tags that are weakly magnetized and will be difficult to detect during tag recovery.

Item: STOP

Options:
0 through 7

Purpose:
A complete cycle of the MKIV Tag Injector consists of seven sequential steps called "stops". By changing the STOP number, the operator can select any one of the points in the cycle as the place where the Injector will start and finish each time a tag is injected.

Figure 6: Stops of a MKIV Tag Injector cycle



Stop 1: The needle/needle carrier is back and tag is magnetized and ready for insertion.

Stop 2: The needle/needle carrier goes forward to a distance set by NEEDLE MOVe (pg. 22)

Stop 3: The tag is pushed forward to a distance set by SHOW (pg. 15).

Stop 4: The needle/needle carrier is retracted.

Stop 5: The uncut tag wire (blue) is retracted leaving the tag behind.

Stop 6: The cutter pin rotates up or down as set by CUT EDGE (pg.23). A new tag is cut.

Stop 7: Cutter pin rotates back and the new tag is ready to be moved forward by the tag wire.

Operation:

1) STOP [1] -- The needle begins at the "Stop 1" position shown in Figure 6. When **[TAG]** is pressed, the needle moves forward into the specimen and the tag is inserted.

2) STOP [2] -- The needle begins at the "Stop 2" position shown in Figure 6. The specimen has the needle inserted into it, **[TAG]** is pressed, the tag is placed, and then the needle retracts out of the specimen. The length of time that the needle stays retracted before returning to the extended position is set using the MIN TIME option.

Note: When "STOP (2)" is used , MIN TIME (pg. 22) should also be adjusted.

3) STOP (0,3-7) -- are for diagnostic purposes and not recommended for tagging specimens. "STOP (0)" puts the Injector in the continuous cycle mode. In this mode once the Injector is cycled it will run continuously until the **[TAG]** key is pressed again.

Item: NEEDLE MOVe

Options:
MAX, NO, S1 - S49

Purpose:
This item sets whether or not the Injector needle moves during the tagging cycle, MAX or NO respectively, or to select a moving needle but with a reduced range of motion (S1-S49).

Operation:
1) NEEDLE MOV(MAX) – The needle travels to its full extent. (See Figure 6, Stop 2 on pg. 21). Most common when using a head mold.

2) NEEDLE MOV**(**NO) – The needle does not move during the tagging cycle. Most common when no head mold or jig is being used.

3) NEEDLE MOV(S1-S49) - Adjusts the amount of needle movement in 0.1mm increments. For example, setting this option to S12 would result in the needle moving forward about 1.2mm.

IMPORTANT: The SHOW value (pg. 15) must be changed when the NEEDLE MOVe is changed.

Table 3: Common SHOW values

2.5" needles		**3.5" needles**	
Needle Move	**SHOW**	**Needle Move**	**SHOW**
No	78	No	171
MAX	96	MAX	193

Item: MIN. TIME

Options:
0 through 255

Purpose:
To allow the operator extra time to remove the specimen before the needle returns to the extended position while using a **STOP [2]** item setting (pg. 21).

Operation:
This function introduces a delay into the injection cycle between Stop 1 and Stop 2 (Figure 6, pg 21). Each unit is equal to 0.01 second (10 msec).

Item: QCD BEEP

Options:
0 through 5

Purpose:
To select the alarm tone for the Injector and QCD.

Item: QCD DELAY

Options:
20 through 150

Purpose:
To set the amount of time the QCD gate actuator or water jet solenoid remains on.

Operation:
Each unit is equal to one hundredth of a second (10 msec).

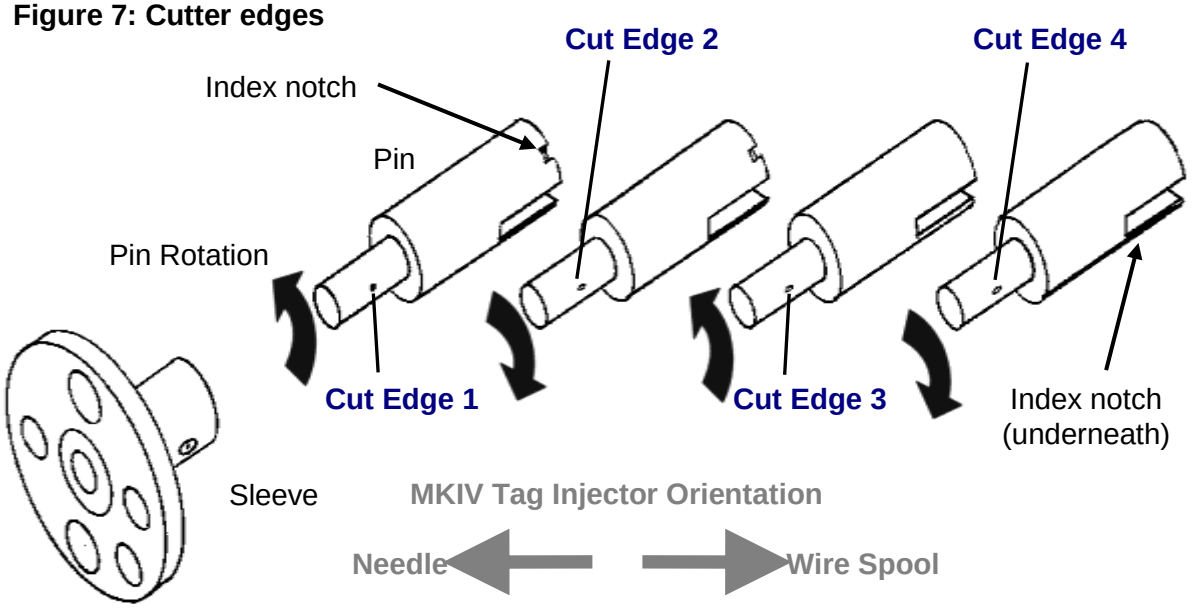
The value should be high enough to sort the largest specimen while at the same time should be small enough to allow the water jets or mechanical gate to turn off/close before the next specimen arrives at the separator.

Note: The QCD DELAY setting does not determine when the water jet comes on, only the length of time it stays on after a tag is detected.

Item: CUT EDGE

Options:
1 through 4

Figure 7: Cutter edges



Purpose:
This item sets which one of the four available edges on the cutter to use (Figure 7, see also Figure 33). Use CUT EDGE to select a new cutting surface when the existing edge becomes worn and will no longer make a clean cut of the tag wire. **It is not necessary to remove the cutter to change the cut edge.** When changing between edges 1 or 2 and 3 or 4, the cutter must rotate 180 degrees. This rotation takes place during the next injection cycle. When removing the cutter, the user should always note the position of the index notch and replace it in the same orientation.

Item: TAG CREDIT

Options:
1 through 5

Purpose:
To set the number of Injector cycles allowed without a corresponding QCD cycle before the missed tag alarm sounds.

Note: The TAG CREDIT setting does not change the QCD's detection and sorting performance. Increasing the TAG CREDIT value simply allows the operator to choose how many tags can be missed before the alarm sounds.

Operation:
The default TAG CREDIT is (2). Reasons to set the TAG CREDIT to a larger value are:

1) If you expect to have more than two specimens tagged before the first of those reach the QCD.
2) If you prefer not to be alerted until more than a few tags have been missed.

Item: US-EURopean

Options:
0,000.0 or 0.000,0

Purpose:
This item sets the 1000 and decimal separator format according to the convention used in the United States or Europe. For example, 1 million = 1,000,000 (US) = 1.000.000 (EUR). This item has no effect on the performance of the equipment.

5
QUALITY CONTROL DEVICE (QCD)

OVERVIEW

The QCD is designed to automatically detect and separate tagged from untagged specimens. When connected to the MKIV Tag Injector, the QCD performs the following operations:

- Detects the magnetized tag.
- Separates tagged from untagged specimens using a mechanical gate or water jets.
- The Injector counts tagged and untagged specimens.
- Sounds the alarm when untagged specimens are diverted (see *Tag Credit* pg. 24).

Figure 8a: Quality Control Device (Mechanical Gate Version) – Blue Box side

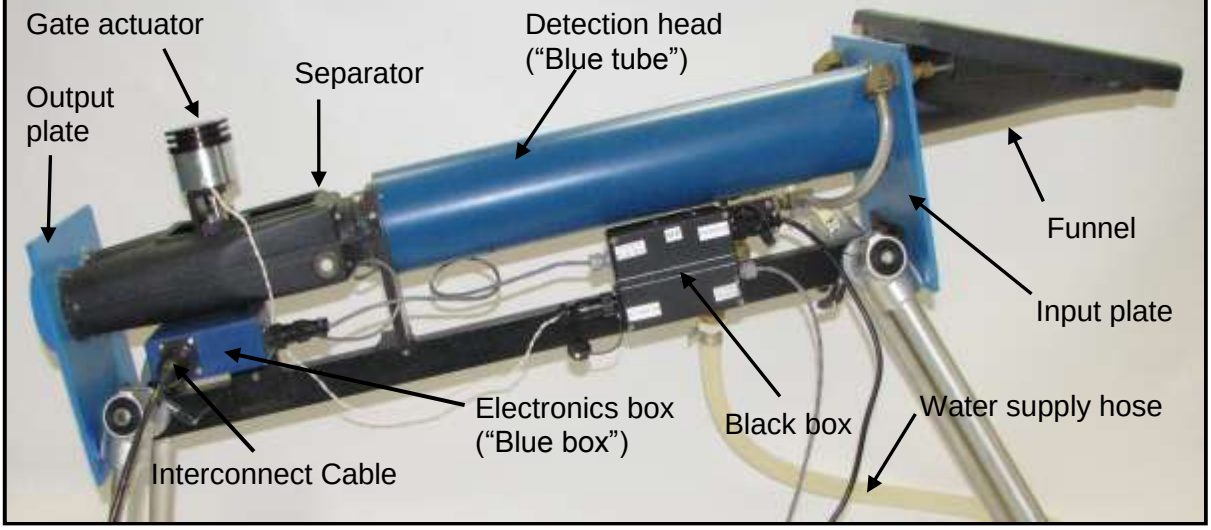
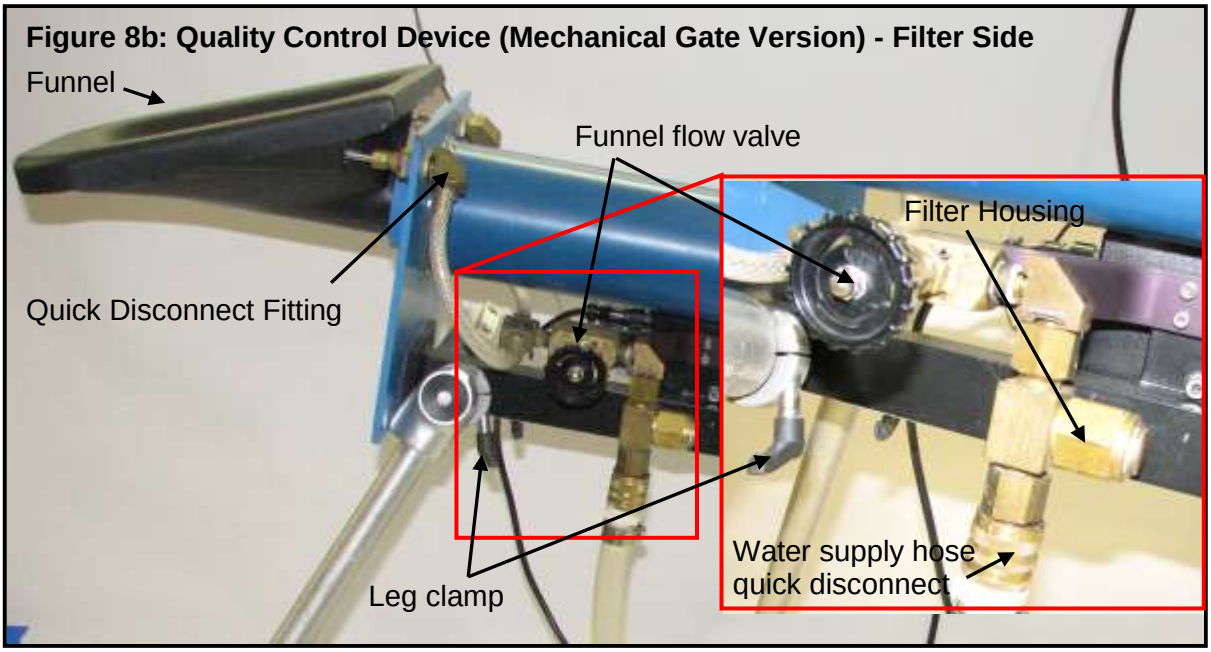


Figure 8b: Quality Control Device (Mechanical Gate Version) - Filter Side



Water flows into the funnel to carry the specimen through the QCD detector head. Either water jets or a mechanical gate in the separator are used to direct the specimen to either the tagged or untagged outlet. When a tag is detected, the solenoid is activated and water flow is directed to the opposite water jet or the gate actuator turns the gate-fin, directing the specimen to the tagged outlet.

The QCD is designed to detect the presence of a magnetized tag in the specimen as it passes through the detection head. Since untagged specimens will not create a magnetic signal, the QCD cannot detect an untagged specimen. Instead, the QCD and Injector work together to decide when an untagged specimen has passed through the QCD. This is done by having each Injector cycle added to a memory buffer, and each tag detected by the QCD subtracted from the same buffer. When the net buffer value limit, as set by TAG CREDIT (pg. 24) is exceeded, it is assumed that a tag was missed and the alarm sounds.

The QCD is designed to detect extremely small changes in the magnetic field that are caused when a tagged specimen passes through the detector head. To prevent false signals, the QCD should not be subjected to unnecessary movement or jarred during operation and should not be operated near sources of strong magnetic fields such as motors, generators etc.

Tip: The effect of known sources of magnetic interference can be minimized by positioning the QCD detection head perpendicular to the source of the interference.

ASSEMBLY

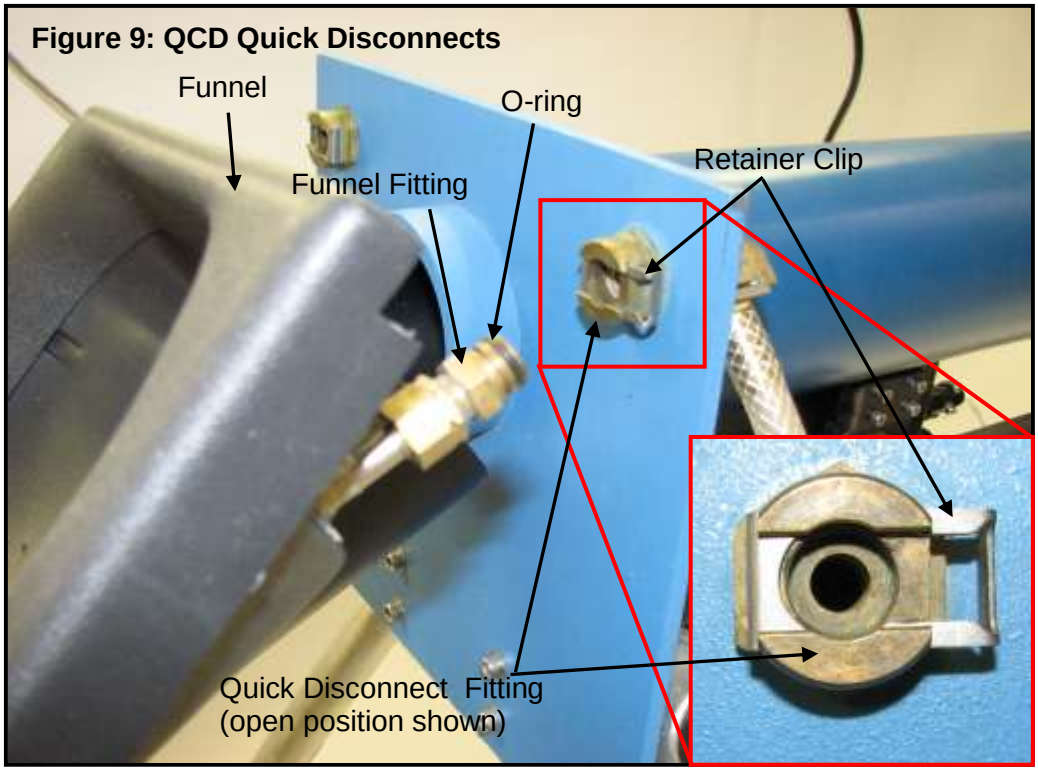
There are two different versions of QCD's. One, the "Mechanical version", uses a fin with an actuator, (Figures 8a and 8b). The other QCD, the "Water jet" version, uses water jets with a solenoid, to divert tagged specimens in the separator (Figures 15a and 15b).

General Assembly (Mechanical and Water Jet Versions)

To assemble the QCD, position the unit upside down (open side of the cover facing up) on the floor or other flat surface. There are two different styles of legs used on the QCD. QCD's manufactured before March, 1990 use a system where wing screws are tightened through the leg brackets against the QCD frame. QCD's manufactured since March, 1990 use a quick release system which compresses a collar and plastic sleeve around the QCD frame.

Collar and sleeve style legs. Loosen the leg clamps (Figure 8b) by turning the small black lever-style handle located at the rotating joint between the legs and the frame of the QCD. Space is limited so the handles cannot always make a full turn. To help in this situation the handles have built-in clutches. Pull the handle out for free turning, allow the spring to pull it back in and it will operate the clamp. Unfold the short legs and position them so they are about 2 mm (1/16 in) from the output plate (Figure 8b) of the QCD. Unfold the long legs and position them so they are approximately 2 mm (1/16 in) from the input plate of the QCD. Tighten the leg clamps to hold the legs in place. Turn the QCD upright and stand it on a level surface.

Attach the QCD funnel to the corresponding connectors at the input end of the QCD (Figure 9). One of the two female quick disconnect fittings is loose in the input plate to make alignment of the funnel easier. Secure the funnel's fittings in place with the retainer clips. The top edge of the funnel should be approximately level. Adjust the legs if necessary.



Tip: Many of the plumbing connections on the QCD use quick disconnect fittings which are held in place by a sliding retainer clip (Figure 9). Sliding the retainer in one direction allows the fitting to be taken apart and sliding the retainer in the opposite direction locks the fittings together. The fittings will go together more easily if the "O" ring is lubricated with water or another lubricant before assembly.

Locate the water supply hose quick disconnect. Screw the threaded end of the connector onto a standard garden hose or other water supply. The other end has a sliding collar which connects to the QCD Filter Assembly (Figure 8b and Figure 39, pg 44). The water supply should provide a flow of about 2 gal/minute (7.5 L/min) at 40 psi (3 kg/cm).

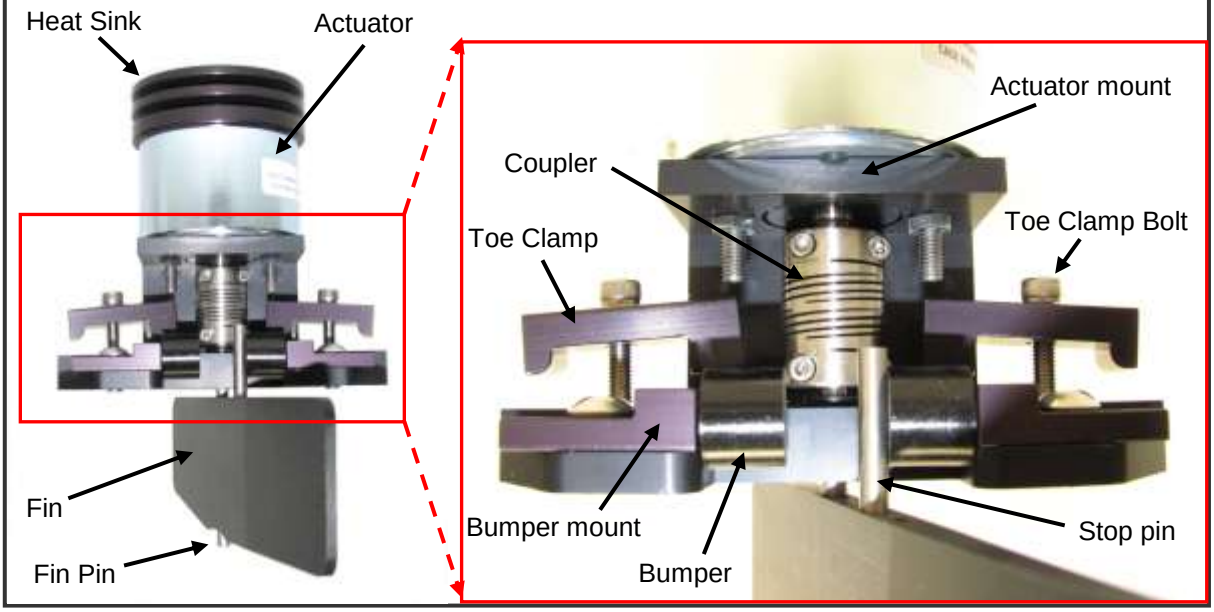
The Interconnect Cable is 10 feet (3 m) long and has the same style connector at each end. Attach the Interconnect Cable from the blue QCD electronics box to either of the two large connectors on the back of the Injector. The two large connectors at the rear of the Injector are identical and may be used interchangeably.

WARNING! DO NOT attach the QCD while the Injector is turned on to avoid DAMAGING the internal electrical components!

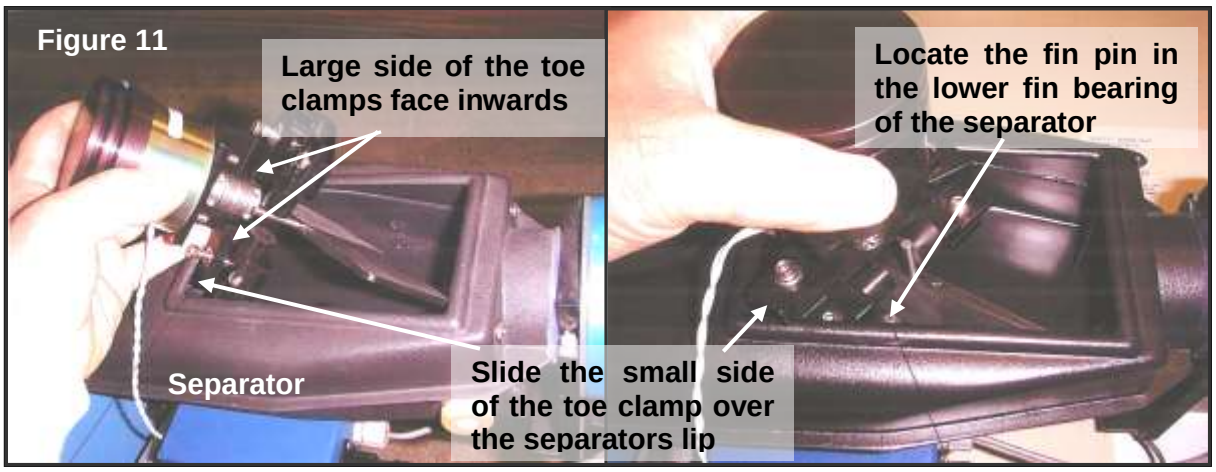
Although the QCD comes equipped with a filter, it is a fine mesh and will quickly become clogged if the water supply contains much debris. We recommend that you filter the water before it reaches the QCD. This can be done with any of the commercially available products designed for larger volumes of water and easy cleaning. Contact NMT if you need assistance selecting one of these filters.

Mechanical Diverter Gate Assembly

Figure 10: Mechanical Gate Parts



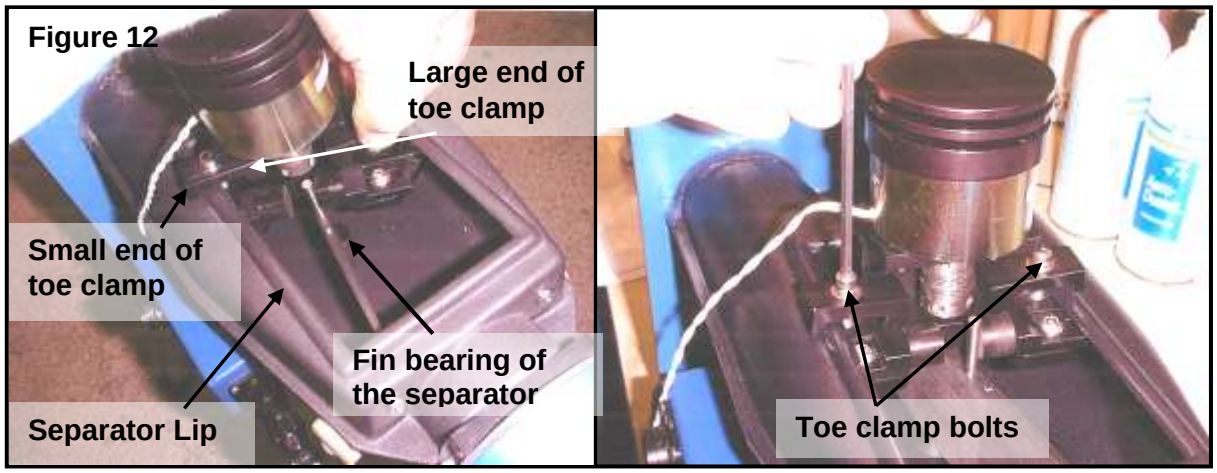
1) With the Toe Clamp bolts loose, rotate the fin over to one side or the other as far as it will go. Tip the long end of the fin down and put it into the separator section first. Slide the Toe clamp over the separator and line-up the Fin pin on the diverter assembly with the Fin bearing of the separator (Figure 11).

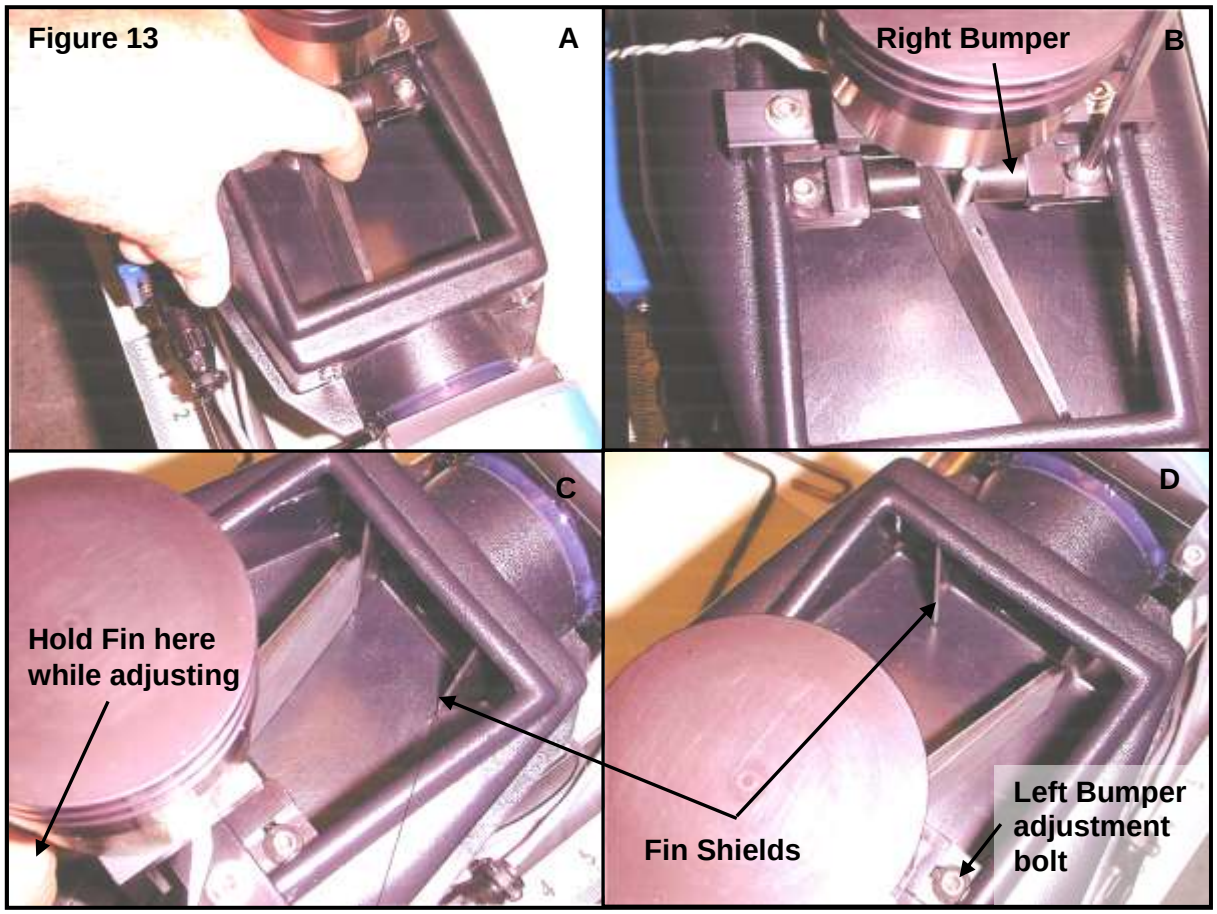


2) Rotate the other toe-clamp end into position. The diverter assembly should now have both of the toe-clamps over the plastic, and the mount under the plastic. Ensure that the "small" end of the toe clamp goes all the way over the separator's lip. Tighten one side's toe clamp bolt a little followed by the opposite side's toe clamp bolt a little. Keep repeating until the diverter gate assembly feels secure (Figure 12).

3) Make sure the fin moves freely (Figure 13A). If the fin is not moving freely then readjust the position of the diverter assembly. Set the right hand bumper stop so that the fin tip is flush with the Fin Shields (Figure 13B and C). Hold the Fin in position while tightening the bumper. This will be the at rest position (no tag present). Move the Fin to the other

(tag present) side and adjust the left bumper so the Fin's tip is flush with its respective Fin Shield (Figure 13D).





4) Plug the actuator into the QCD's Black Box (Figure 1b, pg. 4). Plug the power supply to the Black Box (**NOTE: it must be a 24VDC power supply**). Plug the Black Box to the QCD's Blue Box and the MKIV Tag Injector. To test that the QCD Diverter gate and the Fin are properly adjusted, turn on the Injector, press [SHOW], and then press [STEP] several times (see pg. 15).

SEPARATOR (WATER) JET ADJUSTMENTS

Many QCD's use a water jet system, rather than a mechanical gate in the separator to divert tagged specimens. The two valves located on the side of the QCD are used to control the flow of water to the funnel and the separator.

Figure 14A: Separator (Water) Jet QCD – Valve Side

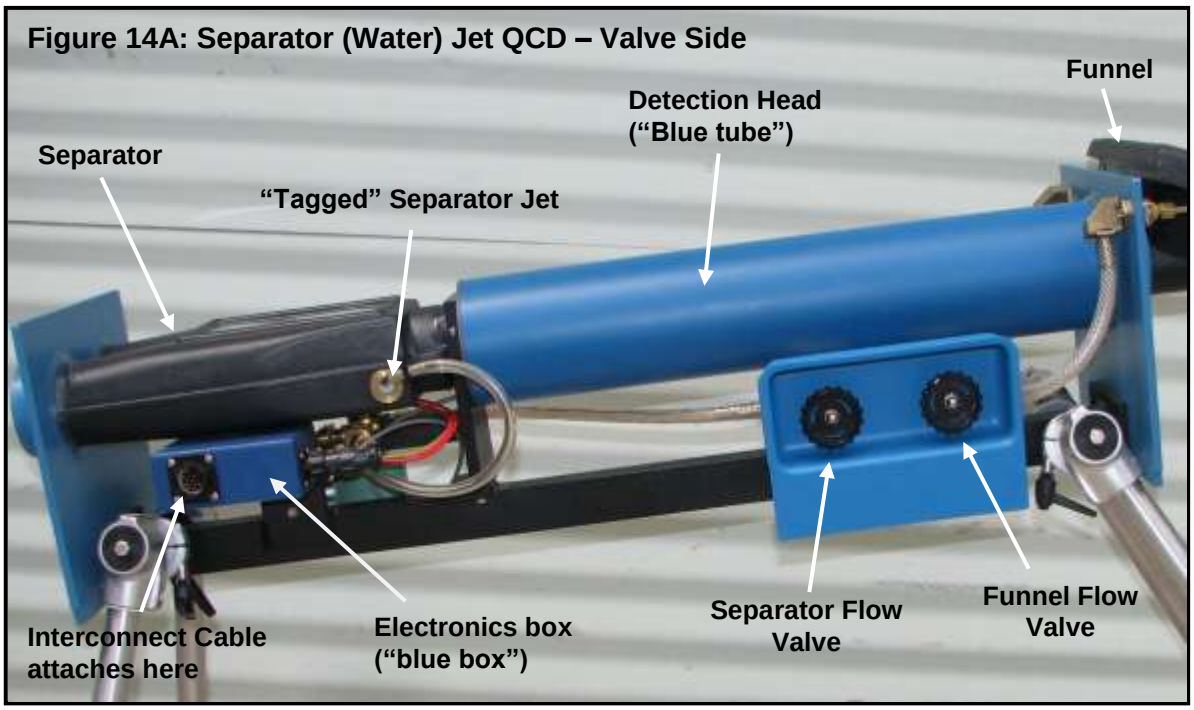
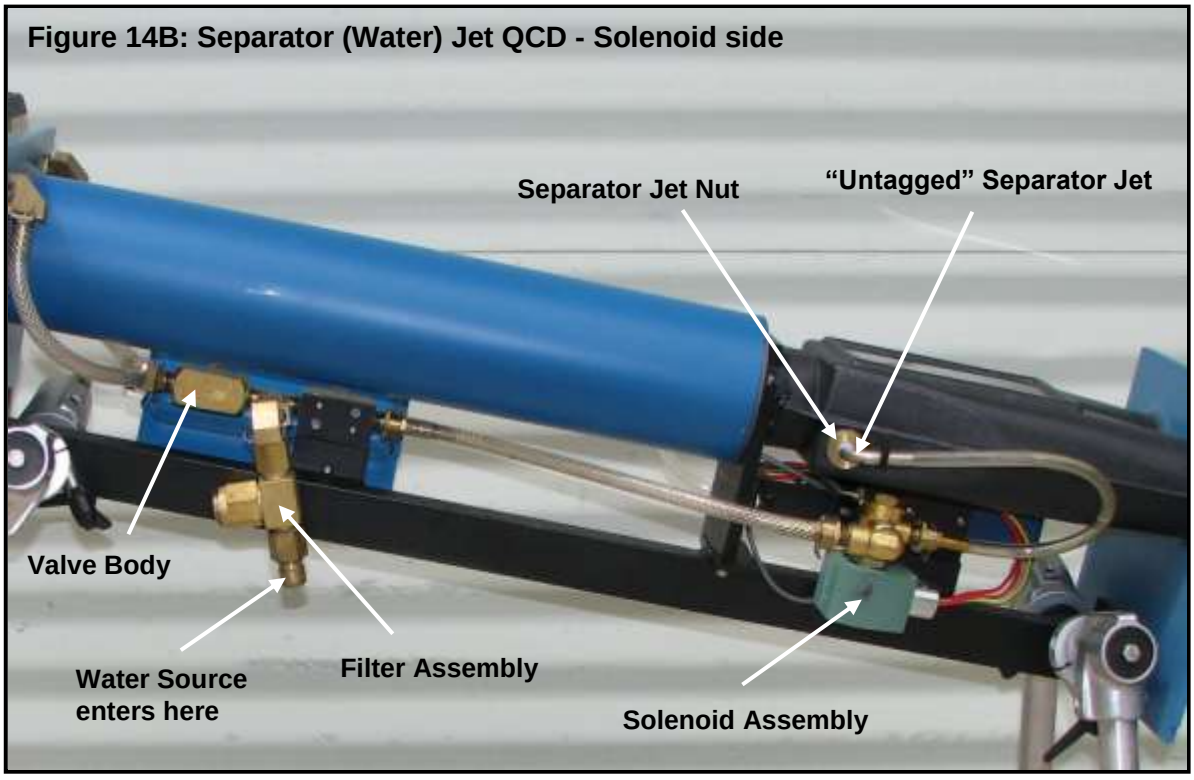


Figure 14B: Separator (Water) Jet QCD - Solenoid side



1) Turn on the water supply to the QCD. ***Adjust the water flow from the funnel using the funnel flow valve*** (Figure 14A). The funnel water flow should be sufficient enough

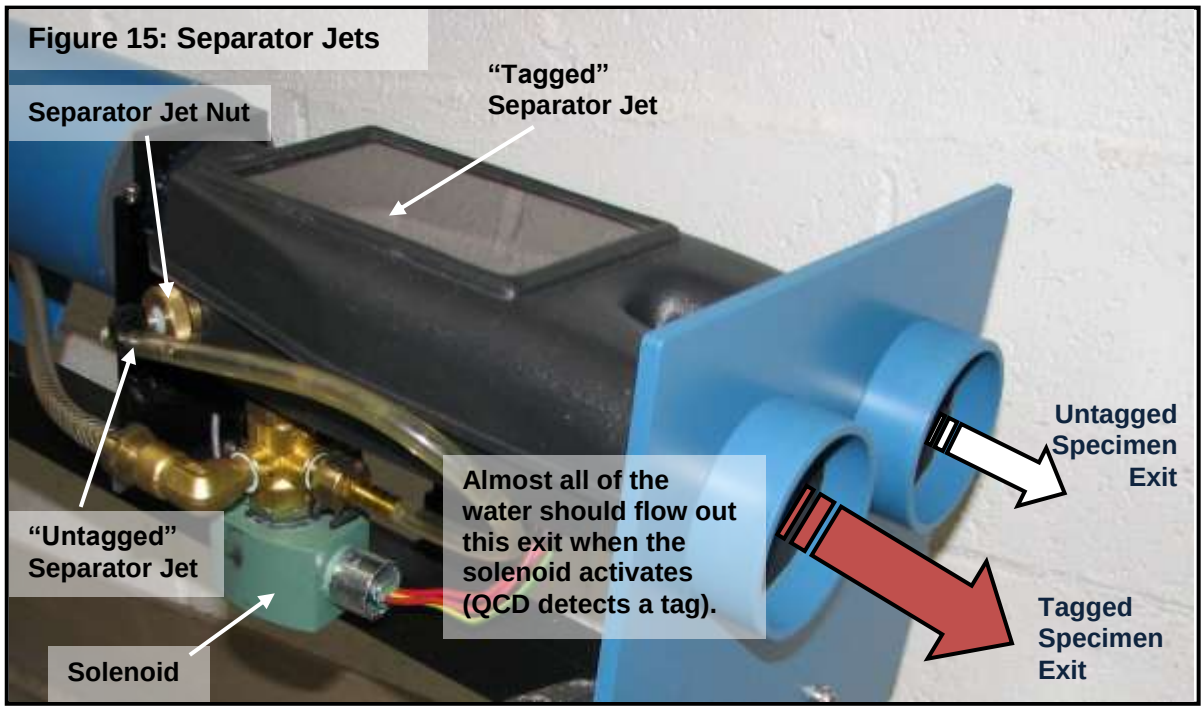
to keep the specimen moving through the QCD, but not so great that the separator jets are ineffective. If too much water is flowing through the detector head, the ability of the separator jets to direct the specimens is diminished.

IMPORTANT: The flow and jet position settings should be checked when specimen size changes significantly, water pressure changes, or sorting accuracy decreases.

2) ***Adjust the water flow to the separator jets using the separator flow valve*** (Figure 14A). The flow should be sufficient to move the specimen to the proper side of the separator, but not so great that the specimen is subjected to excessive forces. Since the water will always be diverted to one jet or the other, the flow to the two separator jets should be equal.

3) ***Adjust the position of the separator jets.*** The jets used in the system work with a wide range of specimen sizes; however, very small or very large specimens require some jet adjustment. Water normally flows from the "untagged" separator jet down one side of the separator, leaving the QCD from only one of the two exits (Figure 15). To activate the solenoid so that you can adjust the jet for tagged specimens, use the **[TAG]** and **[STEP]** keys as explained in the section for the SHOW function (pg. 15). To adjust the jet position, loosen the knurled nuts which hold the jet in the separator housing and position the jets as desired. When the solenoid is activated almost all of the water should be leaving the QCD from the opposite exit.

Figure 15: Separator Jets



Warning: The separator jets' nuts should be **only finger-tight**. Over-tightening may cause the whole jet assembly to turn in the separator housing.

4) ***Adjust the separator jets for the frequency of specimens.*** Use the QCD Delay (pg. 23) in the MKIV Tag Injector's adjustment menu to increase or decrease the amount of time the solenoid stays on. In other words, how long the "tagged" water jet stays on.

6
MAINTENANCE

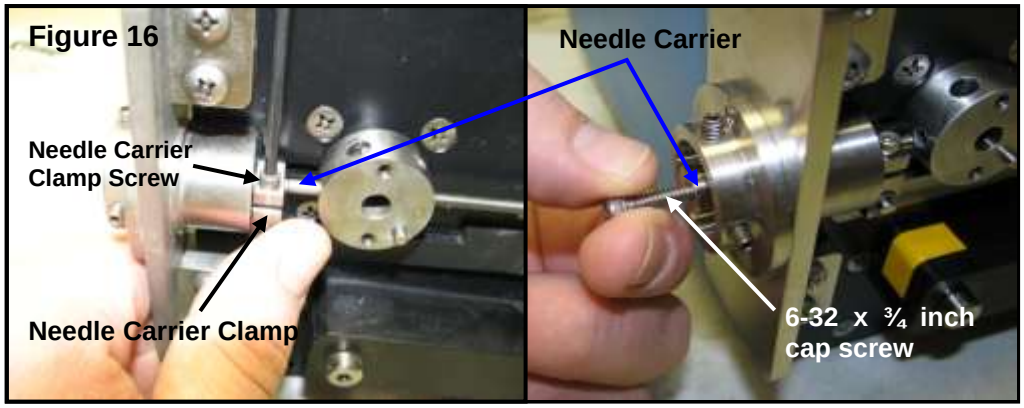
This chapter describes how to completely disassemble the outer parts, reassemble the outer parts, and how to inspect key parts of the MKIV Tag Injector.

The frequency with which various components of the MKIV Tag Injector require maintenance depends on a variety of factors such as water environment (fresh vs. salt), species being tagged and quantity being tagged. Some components, especially the **cutter**, require daily maintenance during tagging. The frequency of maintenance for other components is more dependent on the species and/or target area for the tag. For example, the harder the target location for the tag, the quicker the needle will become dull, and the more frequently it will need to be sharpened. It is recommended that one fully service their Injector prior to storage to ensure it is ready for the next tagging session.

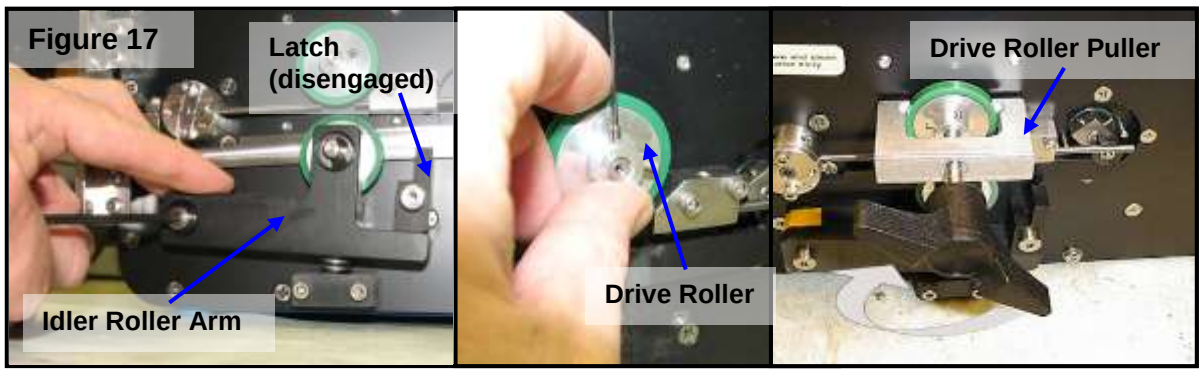
INJECTOR DISASSEMBLY

1) Remove any tag wire from the Injector.

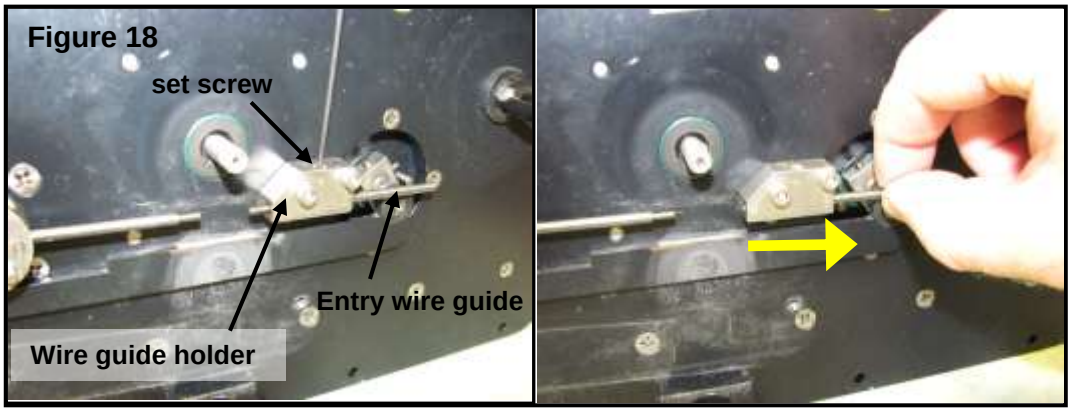
2) Remove the head mold (or needle support tube), the cutter, the brass needle nut and the needle. Loosen the needle carrier clamp screw (Fig. 16) and remove the needle carrier using the 6-32 x ¾ inch socket head cap screw found in the MKIV tool kit (pg. 49).



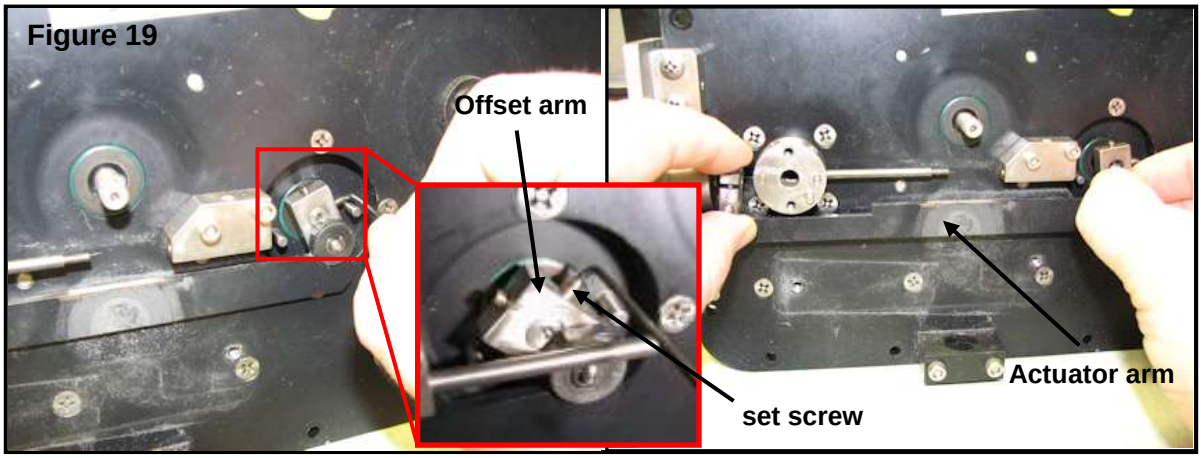
3) Disengage the drive roller latch and remove the idler roller arm followed by the drive roller. If the drive roller is seized to its shaft use the drive roller puller found in the MKIV tool kit (Figure 17).



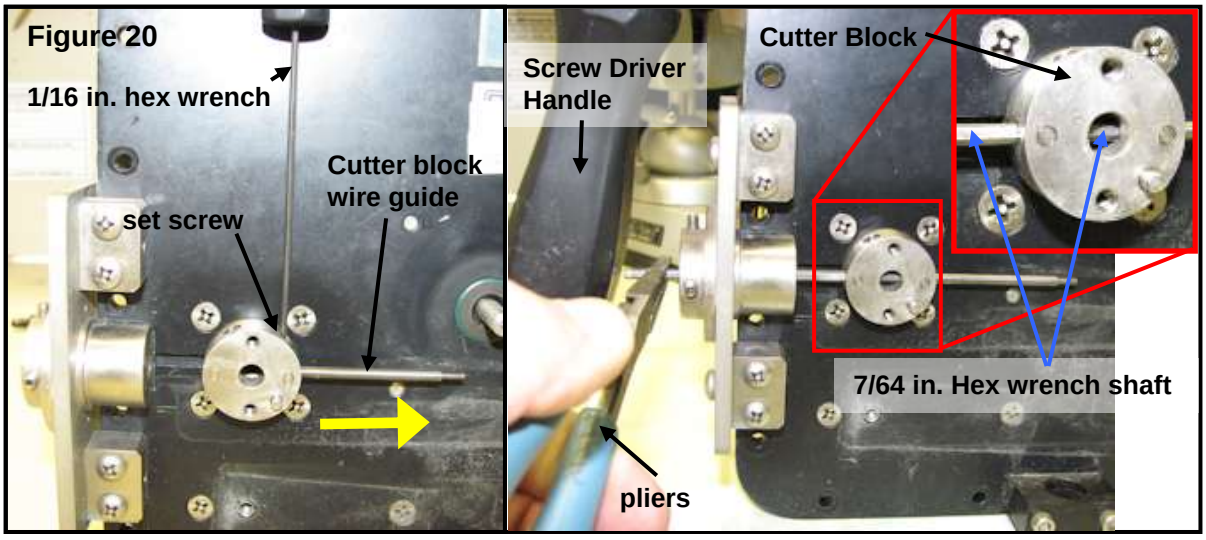
4) Loosen the entry wire guide's set-screw and remove the wire guide (Figure 18).



5) Loosen the set screws in the offset arm and remove the actuator arm using the modified .050" hex wrench in the tool kit (Figure 19).



6) Loosen the set-screw and remove the cutter block wire guide (Figure 20).



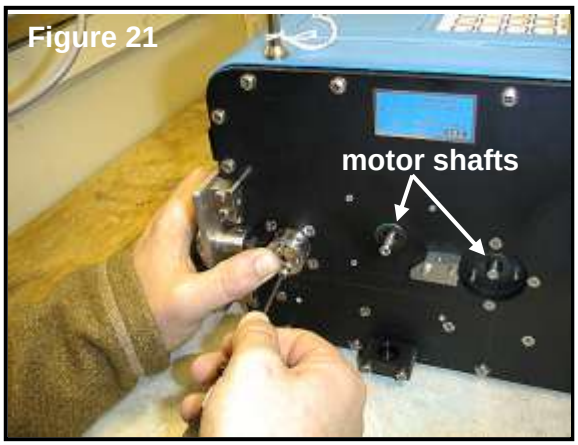
Tip: If the wire guide is stuck, remove the 7/64 inch hex wrench shaft from its handle, butt the hex wrench shaft up to the wire guide inside the cutter block, and use the handle of a screw driver to GENTLY tap the wire guide free (Figure 20).

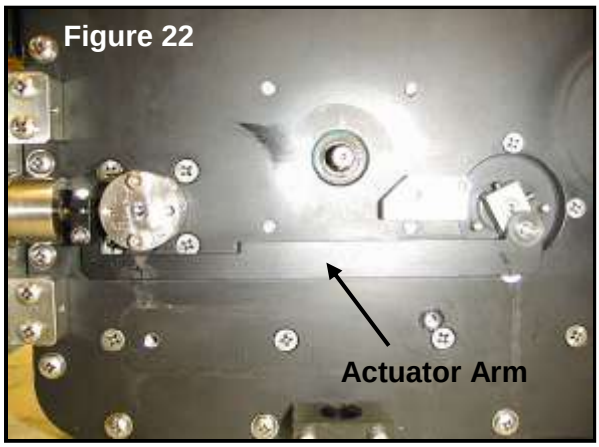
INJECTOR ASSEMBLY

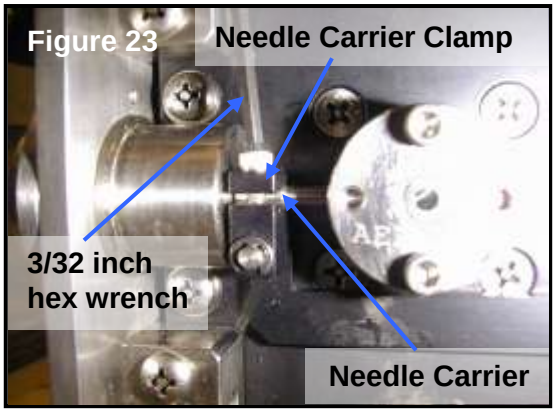
This section assumes that you have already completely disassembled and cleaned (see pg 45) the outside components of a MKIV Tag Injector and are now ready to reassemble them.

1. Insert cutter pin and sleeve. Hold the cutter towards the Injector, compressing the spring while tightening the screws using a *7/64 inch hex wrench* (Figure 21).

2. Lightly lubricate the motor shafts (Figure 21) with silicone based grease and attach the Actuator Arm assembly but do NOT tighten yet (Figure 22).

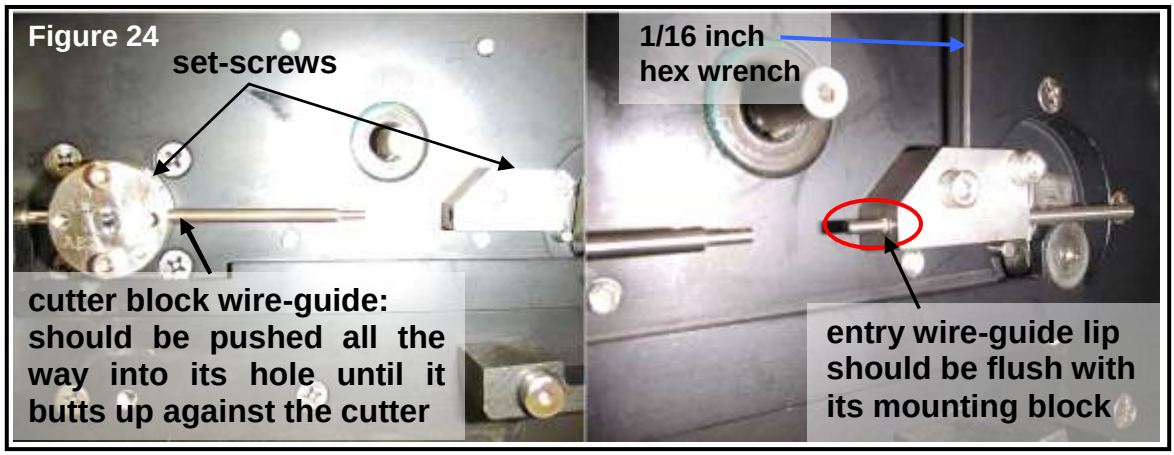


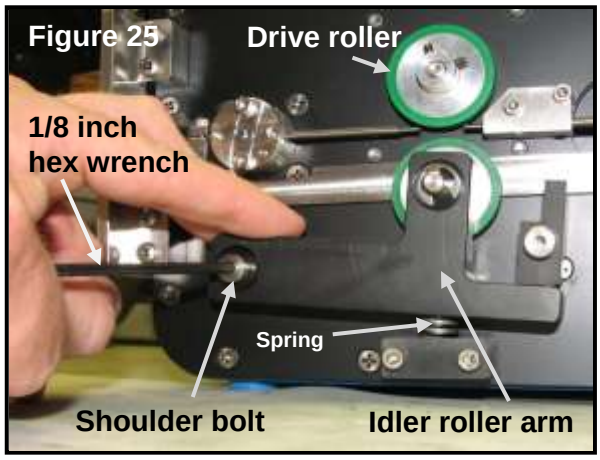


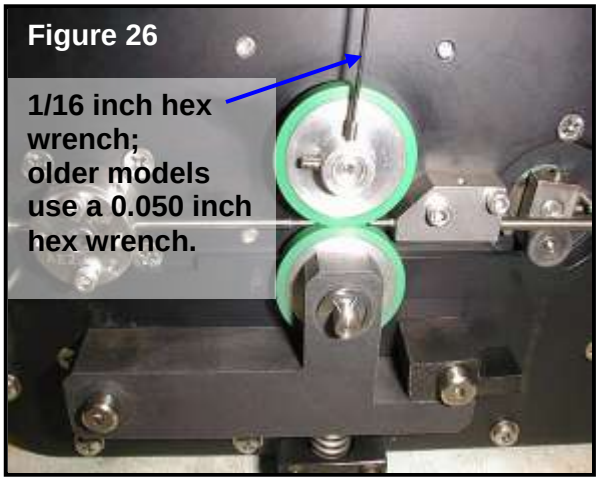


3. Insert the needle carrier so that the back lip of the needle carrier is flush with the rear of the needle carrier clamp. Tighten the needle carrier clamp using a 3/32 inch hex wrench (Figure 23).

4. Slide the cutter block wire guide into its hole until it touches the cutter. Slide the entry wire guide into its mounting block until the lip of the wire guide is flush with the front of the holder (Figure 24).



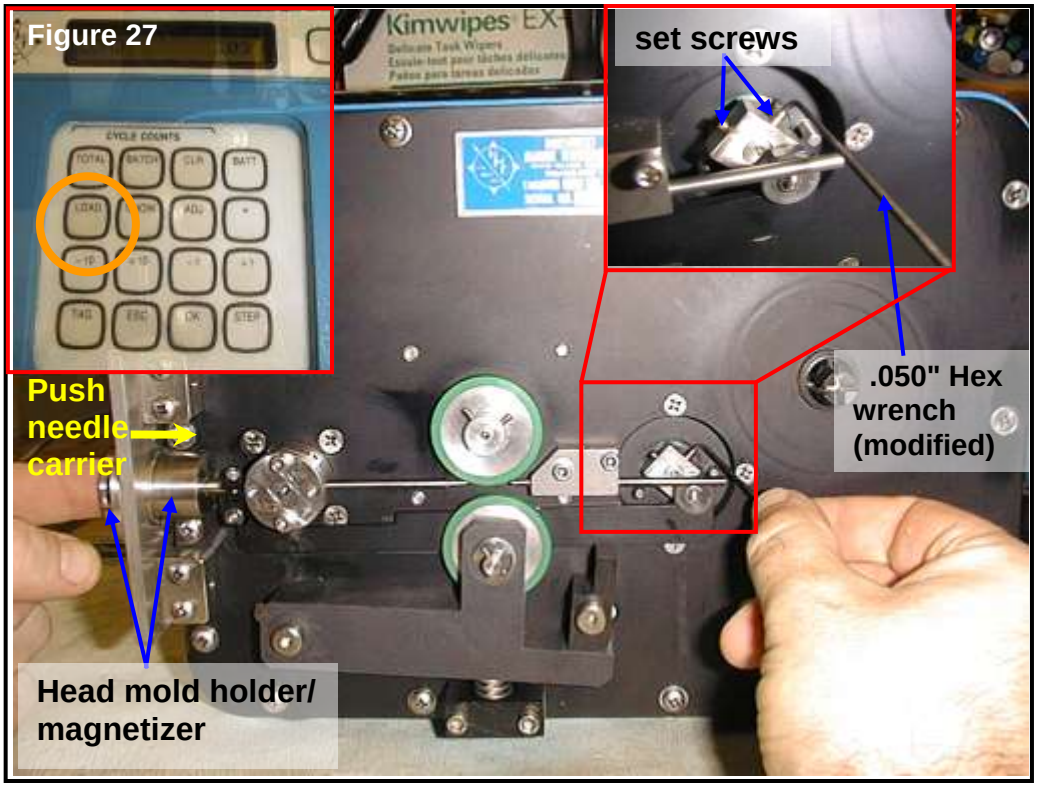




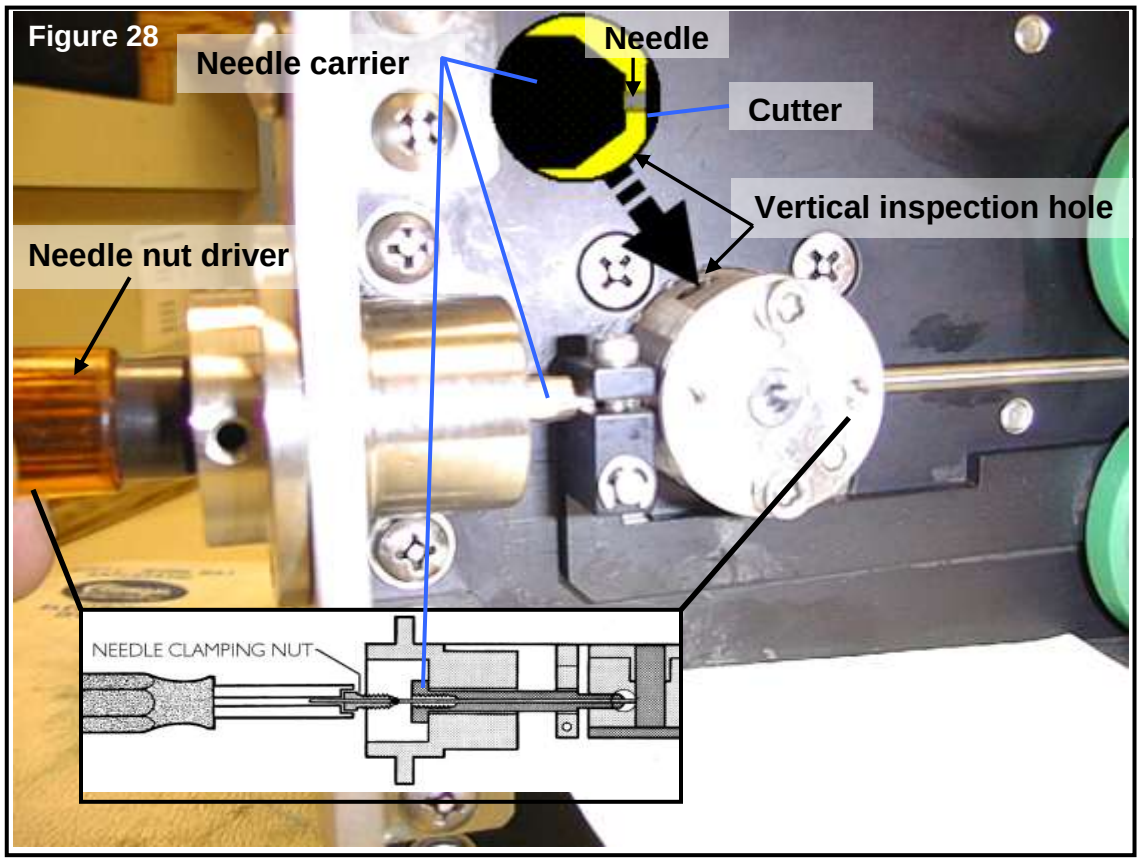
5. Slip the drive roller onto its motor shaft but do NOT tighten its set-screws yet. Fasten the idler roller arm. As you compress the spring while positioning idler roller arm and shoulder bolt, turn the latch to the disengaged position (down). Turning the latch down will not only help in lining up the shoulder bolt, but will also give added protection from the spring slamming the idler roller into the wire-guides (Figure 25).

6. Engage and line up the drive roller with the idler roller. Tighten the set-screws (Figure 26). Disengage the drive rollers.

7. Turn the Injector on and enter *LOAD* mode by pressing the **[LOAD]** key on the top of the Injector. Push on the front side of the needle carrier until it is up against the inside of the head mold holder/magnetizer (Fig. 27). Use the modified 0.050 inch L-shaped hex wrench from the MKIV toolkit and tighten the setscrews of the actuator arm assembly (Fig. 27).

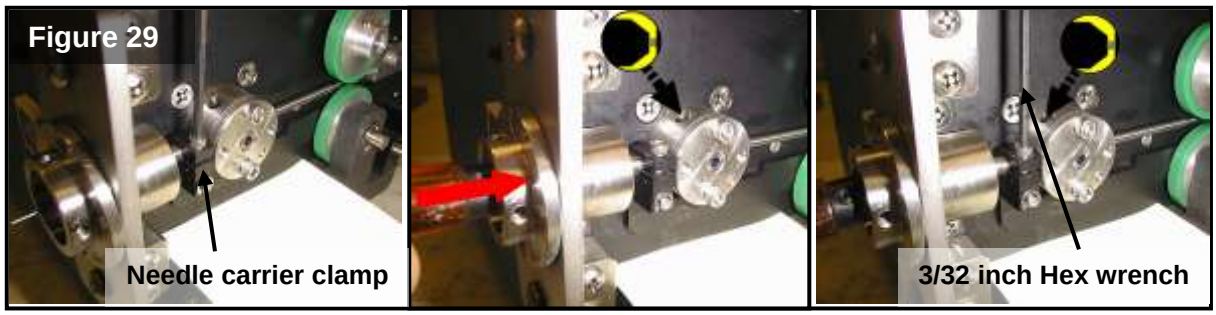


8. With the Injector still in *LOAD* mode, insert the needle until it butts up against the cutter, and tighten the needle nut. A piece of paper or something bright below the vertical inspection hole (Figure 28, 29 and 32) helps to see. Press the **[ESC]** key. The Injector is now properly assembled. Install the head mold, positioning jig or needle support tube and proceed to set up the MKIV's needle penetration and tag placement depth (pg 10).



To be absolutely sure that there is the proper gap between the needle and the cutter follow remaining step.

9. Loosen the needle carrier clamp using the 3/32 inch hex wrench (Figure 29). With the needle carrier clamp still loose, push the needle/needle carrier assembly towards the cutter until you see the funnel end of the needle touch the cutter. Press the **[LOAD]** key, while still holding the needle against the cutter, and then tighten the needle carrier clamp. Press **[ESC]**.



PARTS INSPECTION

NEEDLE

Background

The needle should be kept clean and sharp. A dirty needle may cause tag jamming, improper tag placement, or pathogenic contamination. Clean the needle with detergent and water, then rinse with alcohol. A sharp needle is required to repeatedly penetrate the fish and deliver the tag to the target site.

The needle is held in the needle carrier by a compressed nylon ball slipped over the needle. The ball and needle are retained by a brass clamping nut. The needle carrier is held by the needle carrier clamp located between the cutter and the magnetizer (Figure 2).

Needle Inspection, Reaming and Sharpening

Figure 30

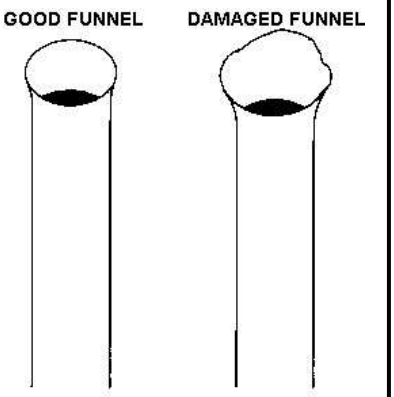
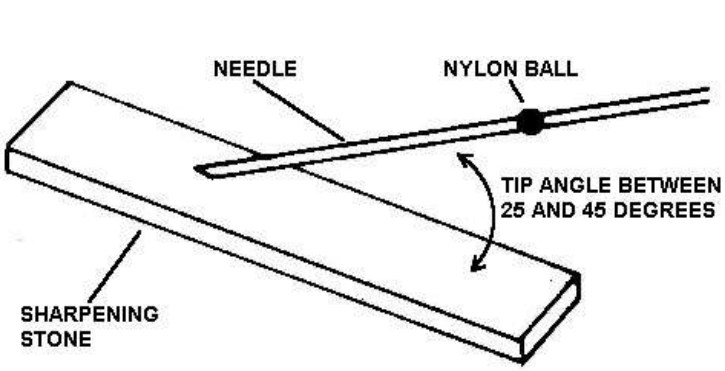


Figure 31



When inspecting or replacing a needle, examine the slight "funnel" at the back end of the needle with the magnifying loupe (Figure 30). The funnel helps guide the tag into the needle and can be damaged if the tag wire jams in the Injector. The funnel can be reshaped using the needle reamer and the sharpening stone in the tool kit. To reshape the funnel insert the point of the reamer into the funnel and turn it a few times with **light pressure** to restore the proper shape. The rim of the funnel must be smoothed with the sharpening stone to remove the external flare caused by reaming. Inspect the needle to make certain it is straight. Bent needles must be replaced.

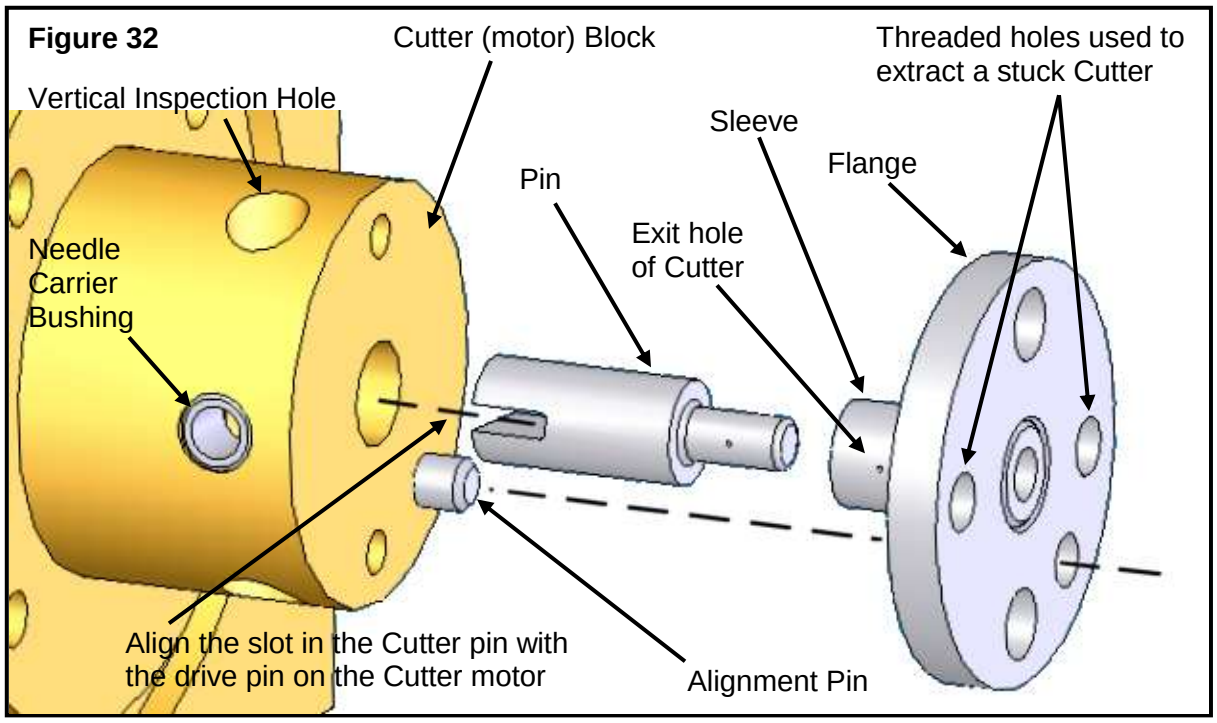
Inspect the beveled end of the needle to see that it is smooth and sharp. A dull needle makes penetration difficult and may tend to push the specimen away during tagging, causing shallow implantation of the tag. The angle of the needle tip can be restored with the sharpening stone and light oil (Figure 31). After sharpening the needle be sure to clean it before reinstallation.

Tip: The needle carrier and needle can be removed as a unit for easier needle maintenance. When removing the needle and needle carrier as a unit it is best to grab it by the brass clamping nut so you don't damage the needle carrier. The needle carrier is a very expensive part compared to the clamping nut. ***Also be careful not to bend the needle.*** When reinstalling the needle/needle carrier unit make sure the Injector is in *LOAD*.

CUTTER

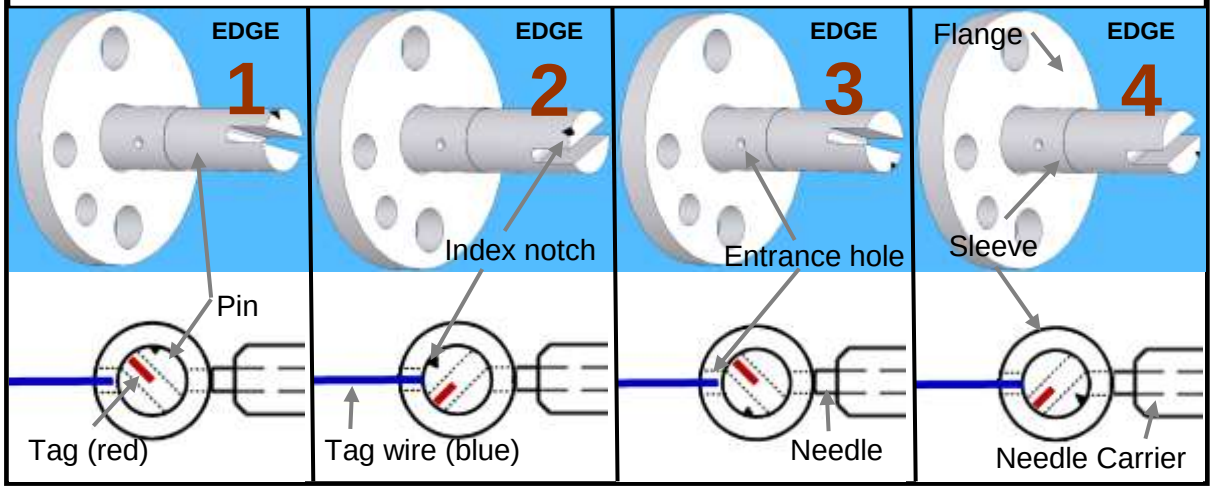
Background

Important! The cutter must be removed and cleaned at the end of each days tagging. Avoid letting the pin and sleeve dry while assembled.



The cutter consists of an inner "pin", a "sleeve" and a "flange" (Figure 32). The tag wire passes through holes in the sleeve and pin. Cutting is performed by rotating the pin within the sleeve, thus shearing off the tag at the point where the wire enters the pin. Each cutter has four cut edges (Figure 7, pg. 23 and Figure 33). The “cut edge” refers to the side of the pin hole doing the work cutting the tag wire.

Figure 33: Cut edges shown from the inside of the MKIV injector looking out.



During normal operation, the cutter does not have to be removed to select a different cut edge; however, a tag will not be cut on the newly selected edge until the Injector is cycled once. A new cut edge can be selected using the *CUT EDGE* item (pg 23) in the *ADJustment* menu (**[ADJ]**). Also, look at the *CUT EDGE* item setting when installing the cutter to make sure the pin is in the correct orientation using the index notch as a reference (Figure 33).

Tip: Record the cut edge change in the log book along with the Injector total ("INJ T"). Keeping track of the number of cuts on a cut edge is useful in determining approximately when the cut edge or cutter needs to be changed.

Keeping the cutter clean will result in the best performance, longest wear and avoids the problem of a seized cutter. Never use tools to disassemble a stuck cutter. Using a screwdriver, pliers or putting the cutter in a vise is almost certain to cause misalignment or breakage. If the pin cannot be removed from the sleeve after the cutter is removed from the Injector, put the cutter in an ultrasonic cleaner (most jewelers have these) with tri-sodium phosphate (TSP) based detergent solution for one hour. This usually allows the pin to be removed from the sleeve by hand. If you have any questions please contact NMT.

Cutter Inspection

Tag quality can be a key indicator of the condition of a cutter or cut edge. Badly worn or damaged cutters can produce tags that are bent or with a large tail (Figure 34). Damaged tags may not pass through the needle, causing the Injector to jam. If half length tags are being cut then the condition of the cut edge becomes more critical. Using a worn cutter can also damage the end of the tag making subsequent reading difficult. Occasionally inspect a tag with the magnifying loupe, Magniviewer™, or on a piece of tape (Figure 34) under a microscope to determine that the tag ends are square.

Figure 34

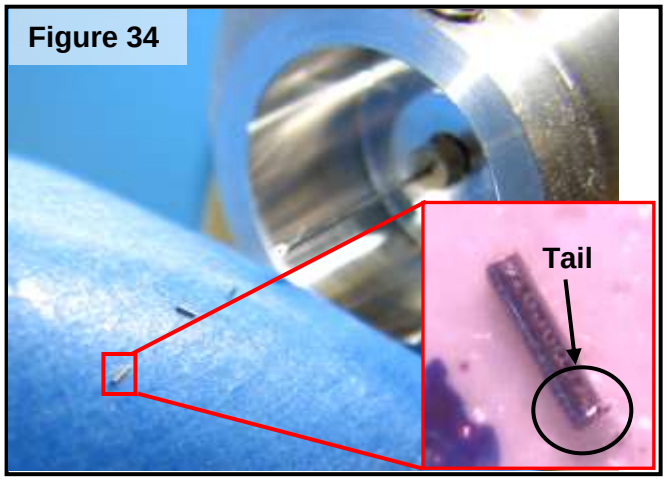
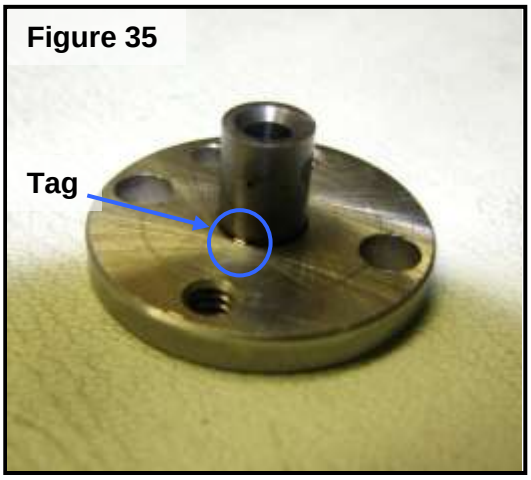


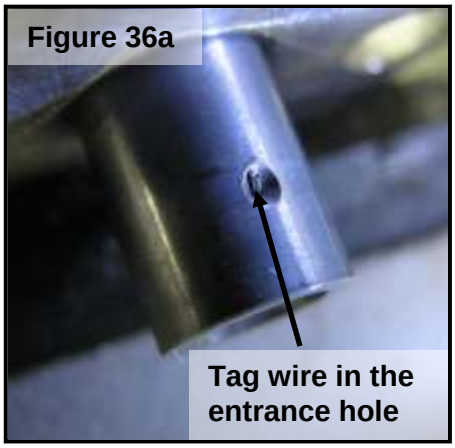
Figure 35

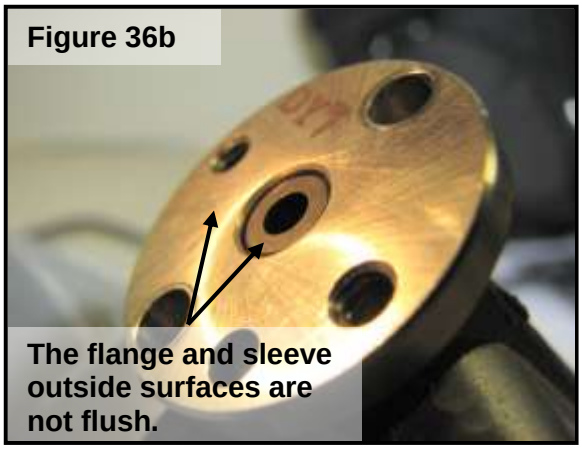


Inspect the flange, cutter block surface, and cutter holes for stray tags or wire (Figures 35 and 36a). This can cause wire jams or make it hard to load wire and possibly damage the cutter. The sharpening stone ("Arkansas stone") found in the MKIV tool kit can be used to take down any high spots from dents created by tags caught between the flange and cutter block surfaces.

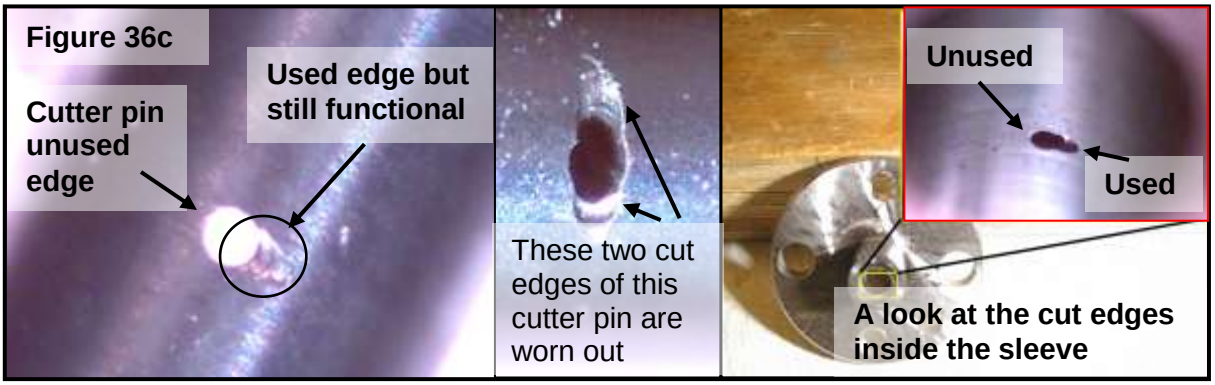
Check the outside surfaces of the flange and sleeve. These two surfaces should be flush to one another. Figure 36b shows a cutter's flange and sleeve whose outside surfaces are not flush. Wire would either not load or load with difficultly through this cutter. If you notice this problem with

your cutter, it should be returned to NMT for attempted repair.



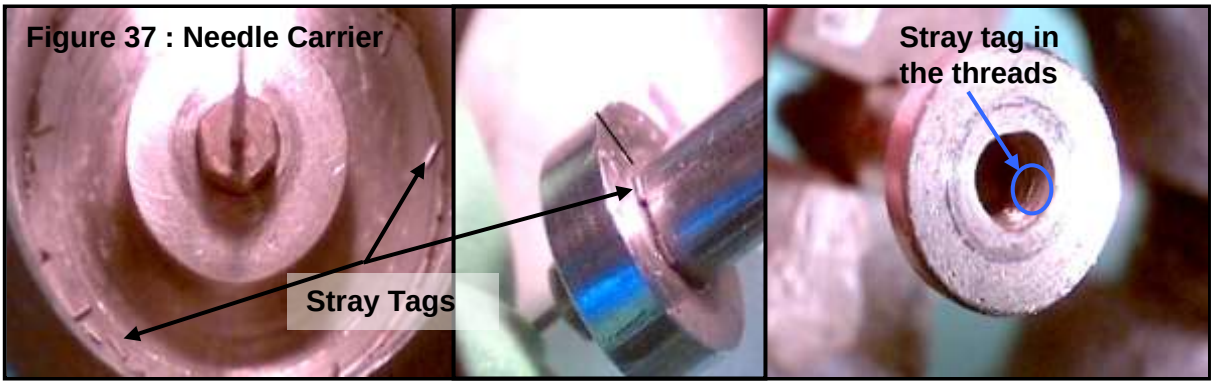


The cut edges of the pin and sleeve should be checked for wear. The pin has four cut edges because it can rotate 180 degrees, while the cutter sleeve only has two cutting surfaces (Figure 36c).



NEEDLE CARRIER

The needle carrier holds the needle in place and is a critical part of the electronic tag magnetization process. Correct installation of the needle carrier is critical to proper system performance (see pg. 37). When inspecting the needle carrier, pay close attention for stray tags in, on and around the needle carrier (Figure 37).



DRIVE ROLLER

Background

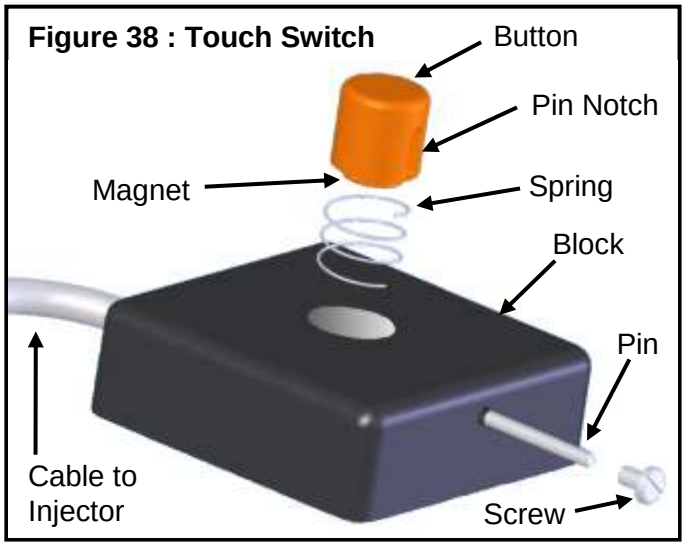
The drive roller is used to transfer the action of the wire drive motor to the tag wire. Since accurate positioning of the tag wire is critical to tag length, magnetization and tag placement depth, you should always be certain that the drive roller and its idler roller are in good working condition and free from contamination by dirt or oils. Oil from certain species can be transferred to the rollers by the action of the tag wire, causing the wire to slip and subsequently cut short tags. Use soap and water to keep the drive rollers clean. Over time, a groove in the drive roller will develop which can also cause the wire to slip.

TOUCH SWITCH

Background

The Touch Switch (Figure 38) is designed for use as a hand switch that can be operated hundreds of times per hour without causing operator fatigue. When the Touch Switch button is pressed, a magnet in the button closes a reed switch in the base and the Injector is cycled.

Figure 38 : Touch Switch



Cleaning

Other than cleaning, the Touch Switch normally requires no maintenance. The Touch Switch can be cleaned by removing the screw in the side of the block, tipping the block to allow the pin which restrains the push button to slide out, and then lifting out the push button and spring underneath (Figure 38). The cavity can then be cleaned and the switch reassembled. Dry the Touch Switch and its connector before storing.

Tip: Some operators place the Touch Switch inside a small plastic bag during use to minimize the accumulation of dirt and water on the switch.

QCD SOLENOID VALVE (Water jet version QCD only)

Background

The QCD solenoid valve (Figure 14B, pg 30) diverts the flow of water to either of the two water jets in the QCD separator. In the inactive position, water is diverted to the separator gate for untagged specimens. When a magnetized tag passes through the QCD, a signal is sent to the solenoid, diverting the water flow to the separator for tagged specimens.

Removal and Installation

The solenoid does not require any routine maintenance; however, you may have to remove the solenoid if it becomes plugged by debris or otherwise fails.

To remove the solenoid follow these steps.

1) Note the position of the three water tubes and disconnect them at the quick disconnect fittings.

2) Disconnect the electrical connector for the solenoid where it enters the QCD electronics (blue box).

3) Remove the wing screw which holds the solenoid bracket to the QCD frame.

4) If you are replacing the solenoid use the 9/64" hex wrench to remove the two cap screws which hold it to the solenoid bracket. It is not necessary to remove the solenoid from the bracket for normal servicing.

5) Reinstall the solenoid using the opposite procedure.

Important: When storing the QCD remove and drain the solenoid. If water freezes inside the solenoid it may be damaged.

Solenoid Valve Cleaning

The QCD filter has been chosen so that anything that passes through the filter will also pass through the solenoid. If the filter has been removed the solenoid can become blocked. The solenoid can usually be cleaned by disconnecting it as explained above and removing the debris from the water passages at the quick disconnect fittings. If the debris is inside the solenoid then it will have to be disassembled.

To disassemble the solenoid, follow these steps:

Tip: Once disassembled, the two sides of the valve body (Figure 39a) are identical so before disassembly, mark the side of the valve body into which the end cap fits.

1) Remove the plastic retaining cap and slip the housing, spring washer, coil and base-plate off the solenoid base sub-assembly.

2) Unscrew the solenoid base sub-assembly from the valve body. This requires a large wrench which is not included in the tool kit.

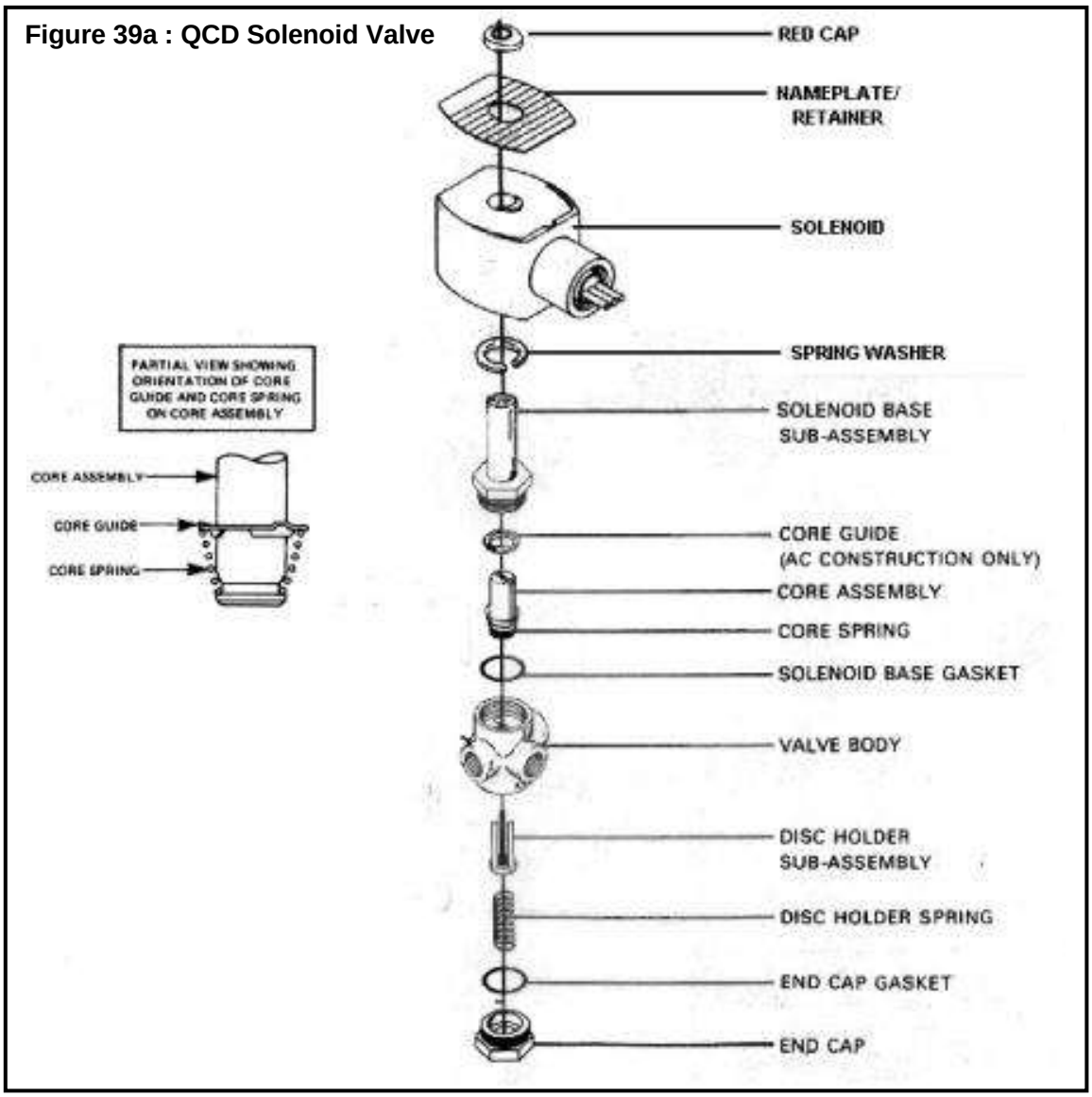
3) Remove the core assembly, core spring and solenoid base gasket. Note that the rubber end of the core assembly goes toward the valve body.

4) Unscrew the end cap and remove the disc holder spring disc holder sub-assembly and end cap gasket. Note that the disc holder sub-assembly has three legs which only fit the valve body one way.

5) All parts are now accessible to clean. Inspect the components and remove any debris. Replacement solenoids are available from NMT.

6) Reassemble in reverse order of disassembly (Figure 39a). The coil should be installed so the larger end faces the base plate (Figure 14b, pg. 30). Lubricate the gaskets with silicone grease. Torque the solenoid base sub-assembly and end cap to about 125 inch pounds.

Figure 39a : QCD Solenoid Valve



QCD FILTER ASSEMBLY (Both QCD versions)

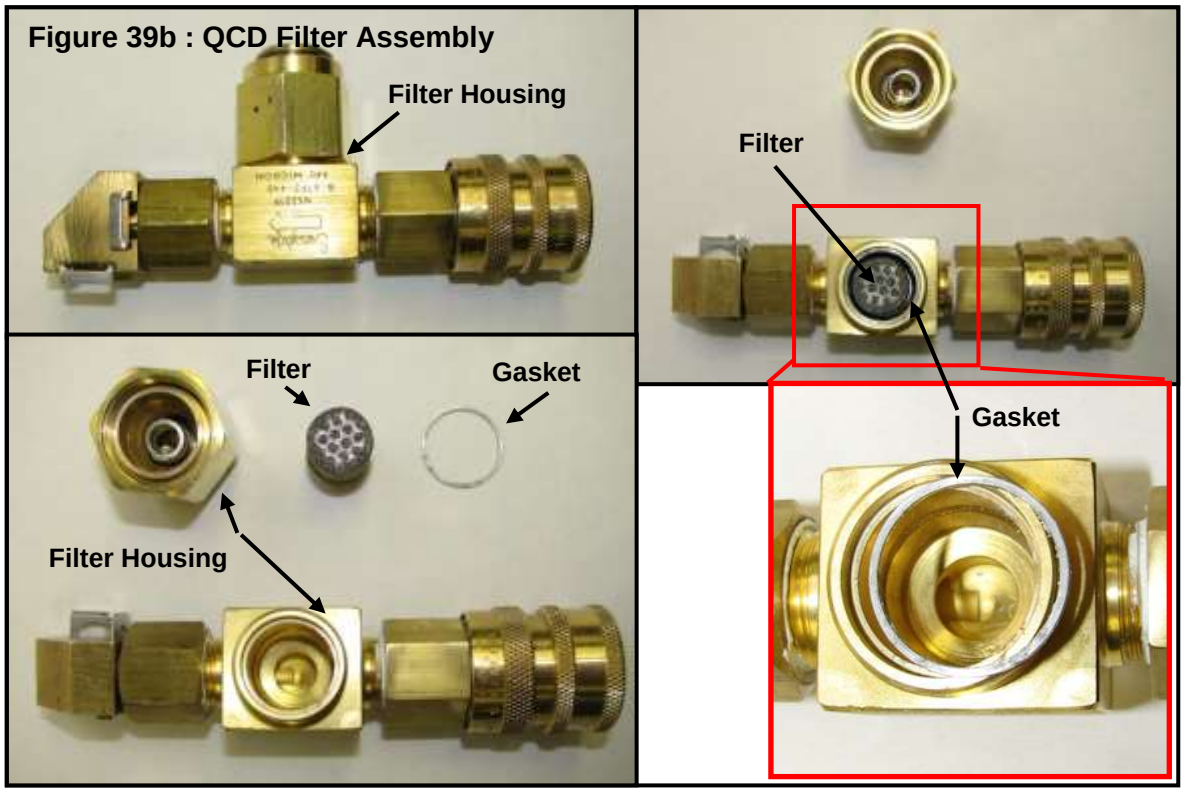
Background

The filter housing (Figure 39b and Figure 8a, pg 25) is between the water supply hose adapter and the QCD valves. The filter housing contains a stainless steel 440 micron filter. The filter is designed to prevent debris from clogging the solenoid valve.

Filter Cleaning

Two methods are available for cleaning the filter. The easiest and fastest is by back flushing with water. To back flush the filter remove the water supply hose from the filter assembly and disconnect the filter assembly from the valve body. Flow water through the filter in the

direction opposite to the normal flow (so water flows opposite the direction of the arrows on the filter assembly). This will usually force most of the loose debris out of the filter.



If the filter must be removed for cleaning or replacement follow these steps.

1) Remove the filter assembly from the QCD.
2) With a large wrench unscrew the housing which contains the filter (Figure 39b). The filter can now be removed for cleaning or replacement. ***Be careful not to loose the gasket***.

Before reinserting the filter inspect the gasket which seals the filter housing. The factory supplied gasket is metal and will eventually wear out. If the gasket is worn it will be evident by water leaking from the small hole in the side of the filter housing. Non-metal replacement gaskets are available from NMT.

Note: The replacement (non-metal) gasket is recommended for salt water use.

CLEANING PROTOCOL

The possibility of spreading fish diseases between culture facilities and watersheds is of concern to both our customers and Northwest Marine Technology. Although we are unaware of a case of coded wire tagging equipment, moved between locations, as having served as a vector in spreading a disease, the potential consequences of such occurrences call for stringent preventative measures. Disinfection procedures should also be implemented between groups of fish, within a facility, when signs of disease exist. **Tagging should not be conducted during a severe outbreak of disease.**

Chlorine solutions are recommended as disinfectants on tagging equipment. Commonly used sources of chlorine are calcium hypochlorite ("HTH") and solutions of sodium

hypochlorite ("bleach"). Household bleach comes in a concentration of about 5% so that to achieve the desired concentration one would dilute to a ratio of 1:250 (1 oz of bleach per 2 gallons water). Stronger solutions may be available at fish rearing facilities so that a lesser proportion of material would be required to achieve the desired concentration (200 ppm) of active ingredient. To reduce corrosion, alcohol (70 - 90%) is recommended as the disinfectant and cleaning agent for the interior mechanisms of the MKIV and other NMT equipment.

Calcium hypochlorite and sodium hypochlorite solutions are highly toxic to fish but can be neutralized by adding sodium thiosulfate or sodium sulfite to the solution. As a "rule of thumb", if a five percent solution of these chlorine compounds is used as a disinfectant, they can be neutralized by adding an equal weight of either chemical. For example, 1 ounce (29.6 mL) of 5% bleach added to 2 gallons (7.57 L) of water would be neutralized by 1 ounce (28.4 g) dry weight of either sodium sulfite or sodium thiosulfate. If the chlorine solution is stronger, the weight of the neutralizing agent should proportionately increase. As an added precaution, "neutralized" disinfectant should not be poured directly into water containing fish.

Important: Before the use of any disinfectant, read and understand the Material Safety Data Sheets (MSDS) for each product.

Equipment and Supplies

In addition to the disinfectants indicated above, the following equipment and supplies are recommended:

- Two spray bottles for dispensing alcohol and chlorine solutions
- Tap (pathogen free) water
- 50 ml syringe with 20 gauge needle
- Wiping sponge/cloth
- Cotton tipped applicators made of wood (available from medical supply stores)
- Cotton balls
- A 2 - 3 inch length of blank/excess coded wire
- DCWT tool kit
- MKIV Tag Injector instruction manual (this manual)
- Paper towels
- An open container for soaking parts
- A pump and appropriate fittings for circulating disinfectant through a QCD
- A large open container for holding and catching disinfectant pumped through a QCD
- Material Safety Data Sheets
- Rubber gloves
- Eye protection
- Particle masks or respirator

Injector

Using tap water and sponge, wipe down the exterior surfaces of the Injector taking care to remove extraneous material. Repeat this procedure with the touch switch, power supply and attendant cords. Following this, choose a well ventilated work location free from hazards that could ignite alcohol. Place the Injector on a clean surface that has been disinfected with the chlorine solution. Secure the MKIV Tag Injector's electrical outlet caps

and wipe all the exterior surfaces with the chlorine solution. Without wetting the electrical connections with the disinfectant, thoroughly wipe the touch switch, power supply and attendant cords.

Remove the head mold and clean with the chlorine disinfectant. DO NOT USE alcohol on the head molds because it may damage the surface material. Open the Injector and remove the tagging needle, needle carrier, clamping nut, and dismantled cutter. Immerse these parts into a container of chlorine disinfectant. Remove the screws that hold the head mold (positioning jig) and immerse them in the same solution. Immerse tools, and other contents of the kit including the case, in the disinfectant. Remove the idler roller arm and the rear wire guide. There is an E clip holding the needle arm on the drive cam. Remove it and the needle arm. Spray the alcohol solution onto the exposed interior surfaces (including the case) taking care to include drive rollers, wire guides, tension spring, drive roller latch (in both up and down positions), hinges, lower drive roller arm, and all screws. With alcohol wetted cotton tipped applicators, thoroughly clean all surfaces and orifices/tubes of the head mold holder, needle carrier, needle carrier clamp, vertical inspection hole, cutter motor drive pin, cutter motor block including hole for cutter pin, and alignment pin. Shift the moving parts to and fro during the process to insure that all surfaces are exposed to the cleansing agent. Remove the caps from the electrical outlets and spray with the alcohol solution allowing evaporation to occur prior to replacing the caps. Similarly spray the electrical connections of the power supply and touch switch.

Rinse the soaking Injector parts, tools and case in tap water. Remove any debris adhering to the cutter parts. Using a length of tagging wire dipped in alcohol, probe the holes in the cutter sleeve and cutter pin to clear them of any material. Insert the tagging needle into the 20 gauge barrel of an alcohol-loaded syringe and force a stream through the tagging needle. After removing the hypodermic needle from the loaded syringe, force alcohol through the needle carrier. Remove the soaking parts and tools, spray with alcohol, and reassemble the parts using disinfected tools. After replacing the 20 gauge hypodermic needle onto the loaded syringe, fit it over the refitted tagging needle and force alcohol through the needle, toward the interior of the Injector, until a steady stream reaches through to the drive rollers. Using the same syringe, insert it into the wire guide leading to the drive rollers, and force alcohol through until a steady stream reaches the drive rollers. Allow the equipment to dry in sunlight if possible.

Quality Control Device (QCD)

Attach the QCD to the MKIV Injector, power source, and tap water, allowing the water to run through the device for several minutes. During this period, divert the flow through both water jets by activating the solenoid valve by pressing [STEP] on the control panel of the MKIV. Using tap water and sponge, wipe down the exterior surfaces of the QCD taking care to remove extraneous material. Following this, choose a well ventilated work location. Place the QCD on a clean surface that has been disinfected with a chlorine solution or other suitable disinfectant.

With the QCD attached to the MKIV and power, spray and wipe down the exposed surfaces of the QCD with a chlorine solution including all surfaces of the legs. Remove the cover and repeat the process on the exposed surfaces, including inside the cover, taking care to reach all of the nooks and crannies. The most practical, and recommended, procedure that follows requires the use of a pump to recirculate chlorine solution through the QCD. Prepare enough solution to operate the pump and place the container in a position to catch the solution exiting the discharged ports as it is pumped/recirculated through the machine.

Allow this to occur for several minutes while diverting the flow through both water jets by again activating the solenoid valve.

After letting the equipment stand for 15 minutes, rinse the surfaces with tap water and then run tap water through the QCD while again activating the solenoid valve. Allow the QCD, with cover removed, to dry in sunlight if possible.

Other disinfection protocols

Care must also be taken to disinfect nets, buckets, hoses, boots, rain gear and any other equipment that has come in contact with fish or fish-bearing water that could serve as a vector for diseases.

Procedures Involving Tagging Trailers

Large scale coded wire tagging operations may involve mobile trailers each housing several tagging units. Disinfection of equipment in these trailers is very similar to the previously described procedures, but in most cases domestic water will not be readily available.

Carefully remove extraneous material from the trailer and equipment using a wash down hose and sponge. Wear protective clothing, and conform to other safety precautions, recommended in the MSDS and open all doors and windows. Into a measured amount of water in a large container, such as holding tank or tote, add an amount of chlorine disinfectant required to achieve the desired concentration. Immerse the main trailer water pump into the container.

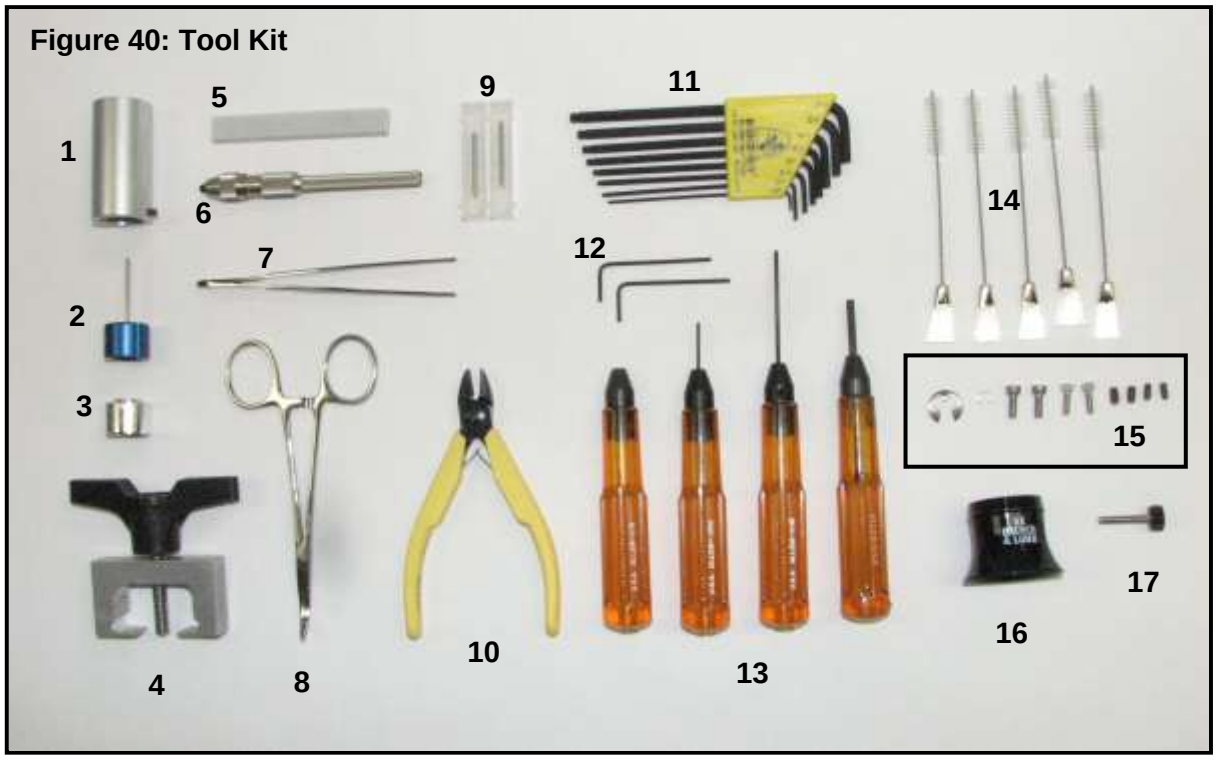
The next procedures follow those already described in previous sections, with the wash down hose used to apply the disinfectant to chlorine disinfectant. Disinfectant must be applied to all surfaces that have, or may have, come in contact with fish or hatchery water. In this case, since tap water is unavailable, the disinfectant is not rinsed from the tagging equipment until the trailer arrives at its next tagging station.

Further details about disinfecting tagging trailers are available from individual agencies and in the users manual for the AutoFish System.

7
APPENDICES

APPENDIX A: Tool Kit Components

Figure 40: Tool Kit



Tool Kit components and their identifying names are shown below. Since the contents are modified from time to time the exact appearance of the components may vary slightly.

1. Needle protector
2. Needle support tube
3. Head mold base
4. Drive Roller Puller
5. Sharpening stone
6. Needle reamer (pin vise)
7. Forceps
8. Hemostat
9. Needle reamer bit
10. Wire cutters with carbide edges
11. Ball hex driver set
12. Wrenches to adjust Hex Wrench length.
13. Hex wrenches
14. Shaver brushes
15. Spare screws and clips
16. 5X Magnifying loupe
17. 6-32 x ¾ inch screw for removing needle carrier

APPENDIX B: Adjustment Menu

ITEM	OPTIONS	REMARKS
SETUP	See Appendix C	Sets certain parameters to pre-defined values
TAG LENgth	HALF, SINGLE, 1 1/2, DOUBLE	Selects tag length
WIRE	NORMAL, EZ-FIND, NON-STD, MAG OFF	Magnetizer Control
QCD THRESHold	0 through 255	Detection sensitivity. Smaller value is more sensitive
STOP	0 through 7	0 is free run. 1 though 7 select other stops in the Injector cycle
NEEDLE MOVe	MAX, NO, S1,...,S49	Activates, deactivates or mini-steps the needle move
MIN. TIME	0 through 255	Injector cycle time in hundredths of a second
QCD BEEP	0 through 5	Selects alarm tone
QCD DELAY	20 through 150	Solenoid valve “on” time in hundredths of a second
CUT EDGE	1 through 4	Selects cutter edge
TAG CREDIT	1 through 5	Number of Injector cycles remembered against QCD activations
US-EUR	0,000.0 or 0.000,0	US or European punctuation

APPENDIX C: Setups

Setup Name	Tag Length	Wire	QCD Thresh	Stop	Needle Move	Min. Time	Typical Use
STANDARD	Single	Normal	50	1	Yes	0	Most tagging
1 ½	1 ½	Normal	50	1	Yes	0	Large specimen, easier to detect
DOUBLE	Double	Normal	50	1	Yes	0	Large specimen, easier to detect
CUSTOM 1	Single	Normal	50	1	Yes	0	Special operator setup[1]
CUSTOM 2	Single	Normal	50	1	Yes	0	Special operator setup[1]
SPECIAL	X	X	X	X	X	X	See note below[2]
HALF EZ	Half	EZ-Find	50	1	Yes	0	not used
HALF	Half	Normal	20	1	Yes	0	Small specimen

1. As delivered, the Injector will have the values shown above for CUSTOM 1 and CUSTOM 2. The operator may change these values as described in the section covering adjustments (pg.19).

2. Any set of adjustment values which does not correspond to the currently active setup (either pre-defined or custom) will show as SPECIAL. This alerts you that non-standard values are active so that unintentional changes do not take place.

APPENDIX D: Size conversion table for salmonids

Size conversion table for salmonids based upon measurements of Chinook salmon.

Numbers per pound	Grams per fish	Fork Lengths	
		Inches	Centimeters
1200	0.33	1.32	3.35
1100	*Conversion not available*		
1000	0.45	1.40	3.56
800	0.57	1.52	3.86
700	0.65	1.58	4.01
600	0.76	1.67	4.24
550	0.82	1.71	4.34
500	0.91	1.77	4.50
475	0.96	1.80	4.57
425	1.07	1.87	4.75
400	1.14	1.91	4.85
380	1.19	1.94	4.92
360	1.26	1.97	5.00
340	1.35	2.02	5.13
320	1.48	2.08	5.28
300	1.52	2.10	5.33
290	1.57	2.13	5.41
280	1.62	2.15	5.46
270	1.68	2.17	5.51
260	1.75	2.20	5.58
250	1.82	2.23	5.66
240	1.89	2.26	5.74
230	1.98	2.28	5.81
220	2.07	2.32	5.94
210	2.16	2.36	6.00

Numbers per pound	Grams per fish	Fork Lengths	
		Inches	Centimeters
200	2.27	2.40	6.10
190	2.39	2.44	6.20
180	2.52	2.49	6.30
170	2.69	2.53	6.40
160	2.84	2.59	6.60
150	3.03	2.64	6.70
140	3.24	2.69	6.83
130	3.49	2.80	7.08
120	3.78	2.85	7.20
110	4.13	2.95	7.45
100	4.54	3.03	7.70
90	5.04	3.13	7.95
80	5.67	3.26	8.30
70	6.48	3.41	8.66
65	*Conversion not available*		
60	7.56	3.56	9.10
50	9.08	3.81	9.70
45	*Conversion not available*		
40	11.54	4.13	10.50
30	15.12	4.51	11.46
20	22.68	5.17	13.13
15	*Conversion not available*		
10	45.36	6.52	16.56
9	50.00	6.73	17.10
5	*Conversion not available*		

NMT stock coho\Chinook head mold sizes are highlighted in yellow.

APPENDIX E: System Messages

The system will display different messages to confirm its operating status. These messages and their meaning are explained below.

BAD DRIVE XY: Indicates an internal failure of the motor or motor drive circuitry. When Y=0 the Wire motor has failed, Y=1 the Needle motor has failed and Y=2 the Cutter motor has failed. The Injector must be returned to NMT for servicing.

BAD MEMORY: The system has a memory which retains menu settings and cycle counts even with the power off. If this memory fails or resets the Injector will display "BAD MEMORY". Press the **[*]**key to clear this message which will prompt the "CHECK ALL ADJ" message. If the message cannot be cleared, the Injector must be returned to NMT for servicing.

CHECK ALL ADJ: The stored settings have been lost and all values have reverted to the standard factory settings. All adjustments should be checked and reset if necessary.

CHECK NEXT TAG: If the wire does not succeed in extending to its proper position, the Injector will complete its cycle, then stall and display this message. (pg. 55)

CUTTER STUCK: The cutter is unable to complete its cycle. (pg. 56)

INT ERROR: Indicates an internal failure. (pg. 54)

NEEDLE STUCK: The needle actuator (drive) arm is unable to extend or return all the way. (pg. 57)

NO QCD OK: This message appears if the Injector is turned on and a QCD is not attached. Pressing **[OK]** to continue if there is no QCD attached.

NO WIRE OR STUCK: At the end of each cycle, the Injector cuts and magnetizes a tag for injection during the next cycle, and verifies that a magnetized tag is actually present in the needle. This test is skipped if the WIRE menu item is set to "(MAG OFF)". (pg. 54)

POWER LOW: This message appears if the power supply voltage to the Injector drops below about 11.5 volts. When the power supply voltage is low the Injector will run slower than normal. You can display the actual voltage by pressing the **[BATT]** key. (pg. 60)

READY VX.X: The power-on message identifies the firmware version "X.X" installed on the Injector. This message also indicates that the equipment has passed the power on self-test. On a MKIVb this message will say **"MK4B V X.X"**.

***RELOAD WIRE:** MK4**b** V X.X only. The Injector has lost the position of the wire due to an improper shutdown. (pg. 64)

WEAK MEMORY: After many years this memory will begin to wear out and will give the warning WEAK MEMORY. After this message is displayed you can safely finish out the tagging season but should return the equipment to NMT at the earliest convenient time.

APPENDIX F: Troubleshooting

1. Injector displays "NO WIRE OR STUCK".

Cause: Tag wire has run out or the drive rollers are not engaged.
Solution: Install a new spool of tag wire. Make sure the drive rollers are in operating position.

Cause: The needle carrier is improperly installed.
Solution: Make sure the needle and needle carrier are properly installed. Refer to pg. 37 step 8 in the *Maintenance* chapter.

Cause: The drive roller is loose or not making firm contact with the wire.
Solution: Confirm that the drive roller is secure to the motor shaft. Confirm that the idler roller can rotate freely. Confirm that the wire guides are NOT making contact with the drive rollers. Inspect both the idler and drive roller for grooves. Sometimes the drive roller can be adjusted on its motor shaft to avoid any grooves in its tread.

Cause: [OK] was used to exit LOAD mode but the wire was not at the tip of the needle causing the wire to be retracted too far.
Solution: Return to *LOAD* mode, turn the drive rollers clockwise by hand to advance the wire to the tip of the needle and press **[OK]**.

Cause: [SHOW] is not set properly. Too small of a *SHOW* value may cause cut tags not to be expelled from the needle and to build up or may cause the tag wire to be retracted too far and not be cut at all. Too large of a *SHOW* value causes the wire to be extended too far and not cut because the Injector cannot find the end of the wire.
Solution: Adjust [SHOW] so that the cut tags are pushed to the end of the needle and are expelled each machine cycle (pg. 15).

Cause: The Injector's magnetizer and/or associated detector electronics may not be operating properly.
Solution: Return Injector to NMT for repair.

2. Injector displays "INT ERROR".

Cause: The Injector has lost track of its motor position.
Solution: Turn the Injector off and remove any wire still loaded. Turn on the Injector. Press the **[OK]** key if the display says "No QCD OK?". Next press the **[LOAD]** key followed by the [**OK]** key ***([ESC] will not work)***. The Injector should now be ready to load wire and resume tagging.

Cause: The Injector's internal circuitry has suffered an unrecoverable failure.
Solution: Return Injector to NMT for repair.

3. Injector displays "CHK NEXT TAG".

Cause: The forward progress of the wire is being hindered.
Solution: Check the wire path (head mold, needle, cutter, and wire guides) for burrs, debris or left over tag wire that could be hindering the movement of the wire. Inspect the needle's funnel and see if the needle itself is bent (pg. 38).

Cause: The forward progress of the wire is not being driven properly (drive roller).
Solution: Confirm that the upper drive roller is tightened to its motor shaft, the idler roller can move freely when not engaged, and that the wire guides are not hindering the movement of the drive roller.

Cause: The current cut edge is worn out and cutting inconsistent tags.
Solution: Inspect the cutter (pg. 40).

Cause: The tag location in the specimen is too hard.
Solution: If the message persists re-examine the biological structure of the specimen for a tag target which is not as hard. Proper needle penetration is important to tag retention. Contact NMT's Biological Services office (pg. 67) for possible tag location options.

4. Tag length varies.

Cause: Drive rollers are loose, wearing out or dirty.
Solution: Tighten, replace, or clean the rollers respectively.

Cause: A wire guide is rubbing against the drive rollers.
Solution: Readjust the wire guide(s) (pg. 35).

Cause: [SHOW] value is too small.
Solution: Adjust [SHOW] so that cut tags are pushed to the end of needle (pg. 15).

Cause: Cut edge is worn out
Solution: Inspect the cut edge being used and if needed change cut edges (pg 23) or replace the cutter.

Cause: Cutter is misaligned from a foreign substance, preventing the cutter from being fully seated on the cutter block.
Solution: Check for stray tags or debris on mating surfaces of cutter flange and cutter block.

5. Tag wire seems to advance normally but then unthreads and backs out when leaving LOAD mode.

Cause: The *SHOW* value is too small.
Solution: This can often happen when switching from 2.5 inch needles to 3.5 inch needles without changing the *SHOW* value too. Increase the *SHOW* value to about where you think it should be (Table 3, pg 22). Then load the tag wire and fine tune the SHOW (pg. 15).

6. A tag is not being ejected from needle each time the Injector is cycled, while testing Injector function without live specimens.

Cause: There is moisture in the needle.
Solution: The hydrostatic force of the water combined with the size of the tags can be enough to make the tags stick together. This is normal. When the tag is injected into the specimen, the force of the tissue on the tag should be enough to overcome the hydrostatic force on the tag.

Cause: The *SHOW* is too small.
Solution: Adjust the *SHOW* value (pg. 15). Use Table 3, pg 22, as a reference to get close.

Cause: The needle carrier is out of adjustment.
Solution: Check the needle carrier's installation/adjustment (pg. 37). Inspect the needle carrier and inside of the head mold holder for stray tags or other items which could be interfering with proper operation (pg. 41).

Cause: The firmware needs to be upgraded.
Solution: Contact NMT (pg. 67) to see if you have the latest firmware.

Cause: Internal circuitry controlling the magnetizer has failed.
Solution: Return to NMT for repair.

7. Injector cycles continuously.

Cause: The *STOP* item in the [ADJ]ust menu is set to 0 (pg. 21).
Solution: Set "STOP (0)" to a value other than zero (default is 1).

Cause: The blue tag button, on the front of the Injector (if equipped) or the touch switch has failed.
Solution: Disconnect the touch switch from the Injector. If the problem goes away, check the touch switch for a stuck button or damaged cable. Clean the touch switch (pg. 42). If the problem persists after removing the touch switch, return the Injector to NMT to replace the blue tagging switch.

8. Injector indicates "CUTTER STUCK".

Cause: The cutter is jammed with tag wire and cannot complete its cycle.
Solution: Refer to the step in this appendix on troubleshooting a wire jam (pg 58).

Cause: The cutter pin and sleeve are seized together from dried foreign matter or corrosion.
Solution: **Great care must be used when attempting to separate a seized pin from its sleeve.** These two parts are made out of carbide. Carbide is very hard but also very brittle and susceptible to breaking. **Separate at your own risk.** Feel free at anytime to send the cutter to NMT if you would like us to separate the pin from the sleeve for you.

Using a screwdriver, pliers or putting the cutter in a vise is almost certain to cause misalignment or breakage. If the pin cannot be removed from the sleeve after the cutter is removed from the Injector, put the cutter in an

ultrasonic cleaner (most jewelers have these) with tri-sodium phosphate (TSP) based detergent solution for one hour. This usually allows the pin to be removed from the sleeve by hand. If you have any questions please contact NMT.

Cause: The cutter motor or its associated circuitry has failed.
Solution: The Injector must be returned to NMT for repair.

9. Injector indicates "NEEDLE STUCK".

The MKIV Tag Injector will sound an alarm and give the "Needle Stuck" error message if the actuator arm can not complete either its forward or return stroke.

Part 1: The return stroke
If the "Needle Stuck" message happens on the return stroke or when turning on the Injector, please try the following to correct the problem:

- Turn off the Injector.
- Loosen the needle carrier clamp.
- Turn on the Injector.

Does the problem go away?

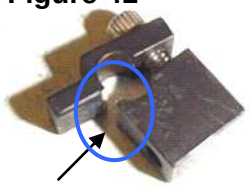
No: Most likely the clamp is running into the cutter block. Turn off the Injector. With the clamp still loose, push the actuator arm forward so the clamp is approximately half way between the cutter block and magnetizer. Turn on the Injector. The clamp and arm will locate themselves to the proper position. Press Load, push the needle carrier/needle all the way towards the cutter and tighten the clamp.

If this still does not help then the actuator arm may be out of adjustment. Readjust the actuator arm by following steps 3,7 and 8 on page 35.

Yes: Remove the needle and needle carrier. Inspect for debris, stray tags or any other foreign objects in the head mold holder or stuck to the needle/needle carrier (pg. 41). Clean these areas. Install the needle and needle carrier by following steps 8 and 9 on page 37.

Part 2: The forward stroke
A "Needle Stuck" failure on the forward stroke could occur for one of the following reasons:

Figure 41



broken needle carrier clamp

a) The head-mold is too far back and the needle carrier is running into it. Reinstall the head-mold slightly further out in the head-mold holder.
b) There's debris on the inside of the head-mold that the needle carrier is running into. Remove and thoroughly clean the head-mold.
c) Inspect the needle carrier clamp to ensure it is not broken and that it can effectively hold the needle carrier. Replace the needle carrier clamp if needed (Figure 41).
d) The end of the needle is running into something that it cannot penetrate. Try switching to non-etched needles if you are using etched needles. You may also need to consider a different tagging location.

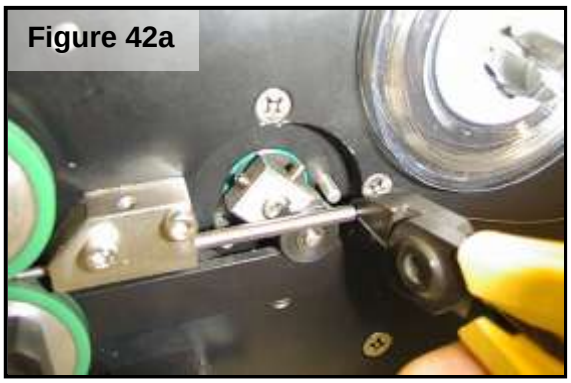
10. The tag wire jams.

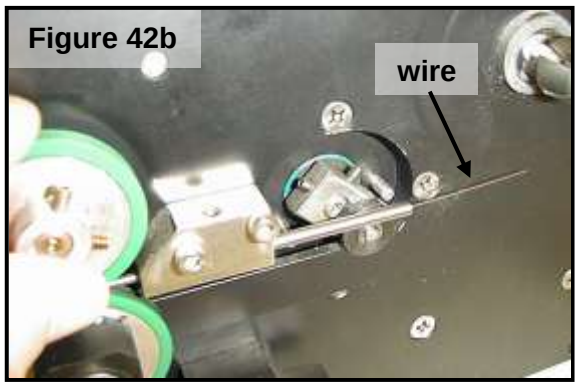
If you are experiencing wire jams in your MKIV Injector, the following will give you some tips on a) how to determine where the MKIV Injector is jamming and b) what you can look for to fix it.

Determining where your MKIV Tag Injector is jammed:

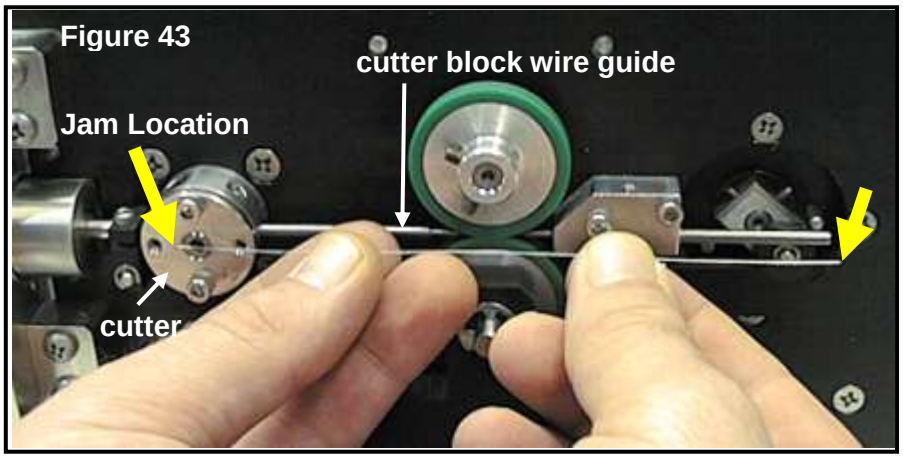
One trick is to use the tag wire as a measuring stick to see exactly where along the wire path the wire is jamming.

a) Turn on the Injector and load the wire until it hits the blockage in the wire path. Cut the wire off at the entry of the rear wire guide (Figure 42a). Turn off the Injector and back the wire out (Figure 42b).

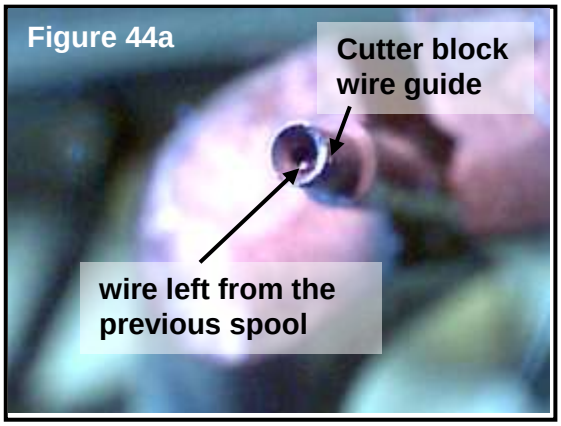


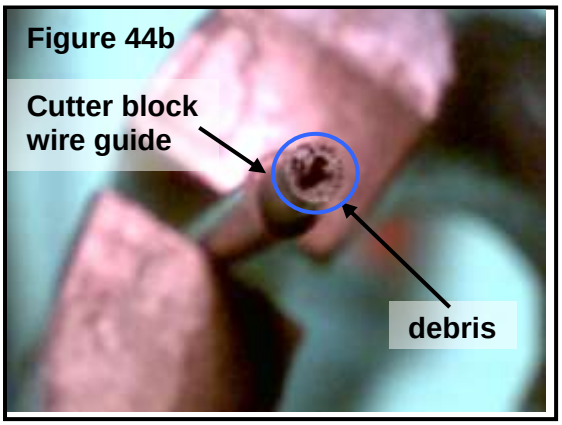


b) Hold the piece of wire in front of the wire path, with one end of wire inline with the entry to the rear wire guide. The other end should now be inline with where the wire is jamming (Figure 43). In this picture we see that this MKIV is jamming at the entrance of the needle, just after passing through the cutter. *Save this piece of wire because it could be a useful tool later on.*



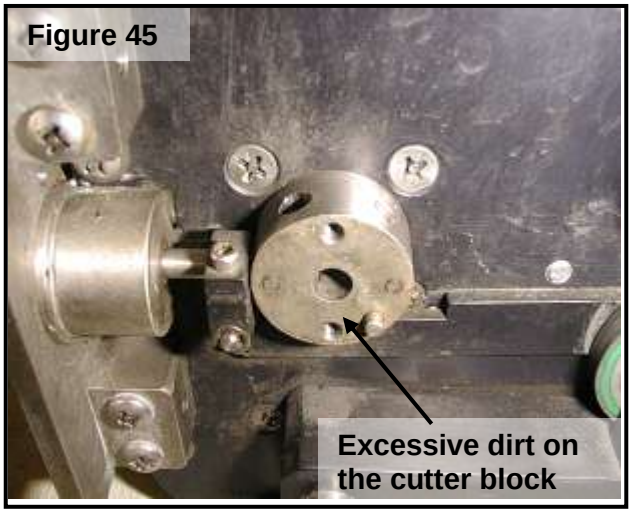
The wire is jamming between the front wire guide and the cutter:

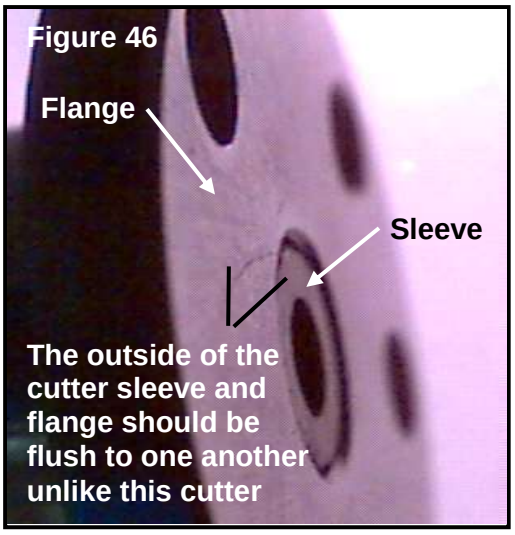




a) Check for wire in the front wire guide and that the wire guides are clear of debris (Figure 44a). Sometimes the last piece of wire from the end of a spool will be forgotten in the wire guide (Figure 44b).

b) Check the cutter and cutter block for excessive dirt and debris (Figure 45), stray tags (pg. 41) and damage (for example, Figure 46). Check the cutter for wire (pg. 40). If wire is found use the piece of tag wire cut earlier (the "measuring stick") to push the stray wire out of the cutter.





The wire is jamming entering the needle:

a) Clear any wire left in the wire path. Inspect the cutter's cut edges and change cut edges if necessary (pg. 23).

b) Check the needle and needle carrier for any wire (Figure 47), debris build up (Figure 48) or stray tags. The piece of wire used to determine where the Injector is jamming, the "measuring stick", is a useful tool to clear any wire out of the needle (Figure 49). Make sure the needle is not bent and that the funnel (cutter) side of the needle is not damaged (pg. 38).

c) Check that the needle carrier clamp is not broken (Figure 41).

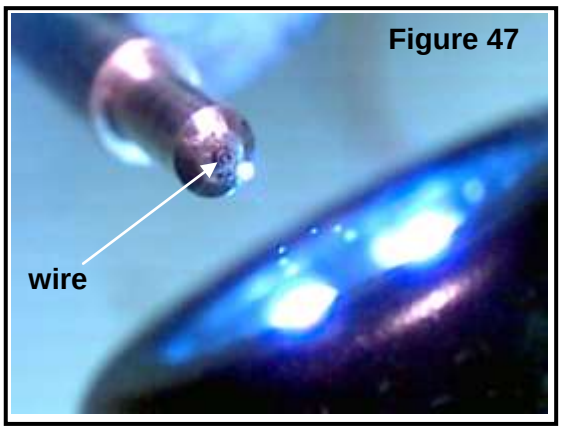


Figure 47


Figure 48

d) Make sure the needle carrier and needle are properly installed (pg. 37).

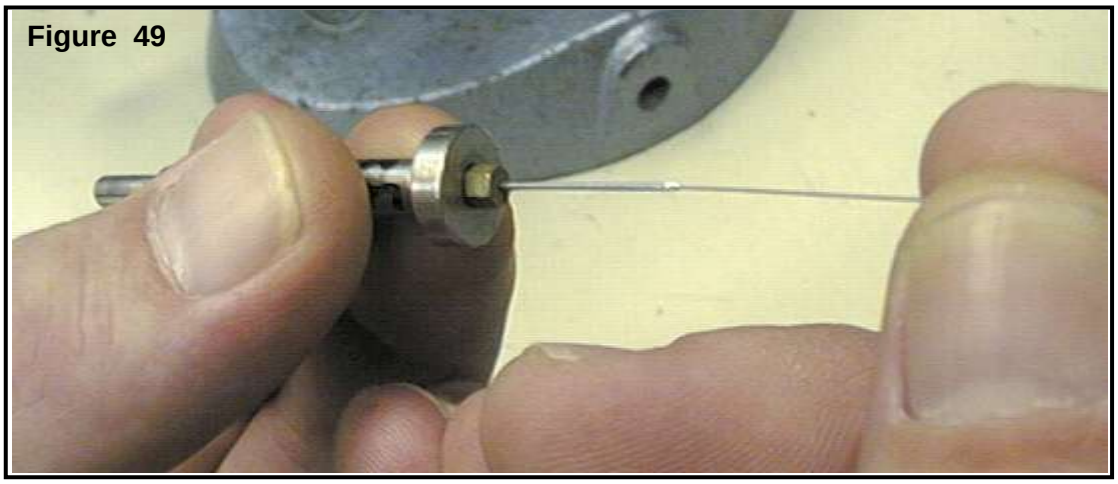


Figure 49

The wire is jamming in the cutter:

a) Clear any wire left in the wire path. Inspect the cutter's cut edges and change cut edges if necessary (pg. 23, pg. 40).

b) Verify that the cutter sleeve is flush in its flange (Figure 46).

c) Check that the spring behind the cutter motor drive pin is not stuck and that no debris is trapped in there.

d) Check for stray tags in the cutter block and on the cutter block-flange mating surfaces. Use the sharpening stone in the MKIV tool kit to take down any high spots on the cutter block or inside of the flange.

11. Injector indicates "POWER LOW"

Cause: The DC voltage from the power supply to the Injector is too low.
Solution: Check the AC line voltage with a voltmeter if available. Check the DC voltage from the power supply at the 4 pin connector, between pins 2 (+VDC) and 4 (ground) that plugs into the MKIV Injector. This voltage should be at least 12 VDC for an Injector without a QCD or using a QCD with a water jet (solenoid) diverter. Press [BATT] on the key pad and confirm that the voltage, with the

Injector and QCD at idle, is above 11.8 VDC (as read from the Injector's display). ***If the Injector is using a QCD with a mechanical (actuator gate) diverter the voltage needs to be at least 24 VDC***.

Cause: The Injector is a MK4b and using a power supply whose output is not 24 VDC.
Solution: Verify that the Injector is a MK4b by observing the power-on message. If the power on message, following "NO QCD OK?" (if applicable), reads "MK4B V X.X" the Injector is a MK4b. If the Injector is a MK4b connect it to a power supply with an output of 24 VDC.

12. Nothing happens when Injector power switch is turned on.

Cause: The Injector's circuit breaker is tripped or the internal fuse is blown.
Solution: The On/Off switch contains a circuit breaker. If circuit breaker has tripped it will automatically reset within about 1 minute. If internal fuse has blown, the Injector must be returned to NMT for repair.

Cause: Power source or supply is faulty.
Solution: Verify there is power to the power supply (AC) or the batteries are charged (DC). Inspect for damaged pins or cable. Try another power supply if one is available.

13. The QCD is not detecting tagged specimens.

Cause: Specimen does not contain a tag.
Solution: Check insertion technique, tag placement depth, suitability of tag target area, head mold or positioning fixture suitability, drive roller condition and needle condition.

Cause: QCD threshold setting too high (see pg. 20).
Solution: Check threshold setting. Setting should be about 50 for standard tag and 20 for a half-length tag in axial plane, 15-20 for standard tag in transverse plane.

Cause: Tag is not properly magnetized.
Solution: Check to make sure the Injector has not accidentally been set to "WIRE (MAG OFF)". Confirm that the needle carrier is properly installed (pg. 37) .

Cause: QCD Interconnect Cable is faulty or the connection is poor.
Solution: Reconnect or replace cable.

14. The QCD count increases (detects tagged specimens) but the actuator/solenoid does not activate

Cause: The actuator/solenoid is not activating when the QCD detects a tag. Test the actuator/solenoid by pressing **[SHOW]** then **[TAG]** (pg. 15).
Solution: Unplug and plug back in the electrical connection to actuator/solenoid from the QCD Blue Box (pg.29) and retry. Clean the solenoid if it is still not working. If it is a mechanical gate check if the gate fin is moving freely in the separator.

15. QCD actuator/solenoid activates but specimens are not properly sorted.

Cause: Incorrect water pressure.
Solution: Check the water pressure to the QCD. Recommended flow is 2 gallons per minute at 40 psi. Check the amount of water that is diverted to the funnel and solenoid. If the funnel flow is excessive and the flow to the solenoid is restricted, the jets may not be able to influence the direction of the specimen. Check the QCD filter. A dirty filter can restrict the water flow.

Cause: The Separator jets are not adjusted properly.
Solution: Alternate between each water jet by pressing **[SHOW]** then **[STEP]** (pg. 15). If necessary, a more direct stream of water can be obtained by bending back the deflector at the tip of the water jet.

Cause: The QCD DELAY is incorrect.
Solution: Check the QCD DELAY item in the adjustment menu (pg. 23). Larger specimens require more delay so that the water jet will stay on longer.

Cause: Solenoid will not turn off or water flows from both separator jets at the same time.
Solution: The rubber seal inside solenoid is stuck or has been damaged. Disassemble the solenoid and inspect for cleanliness or damage to the seal. Debris could be restricting the movement of the valve mechanism or excessive water pressure can damage the rubber seal. Remove any debris. If seal is damaged the solenoid will have to be replaced.

Cause: The mechanical gate is not properly attached to the separator.
Solution: Readjust the toe clamps (pg. 28).

16. Operation of the separator jets is reversed. Sorting is to the opposite side from before.

Cause: Hoses from the solenoid to the separator jets are reversed or the solenoid has been reassembled with the solenoid base subassembly and end cap on opposite sides.
Solution: Check that hoses from the solenoid are connected to the correct ports. Check that the end cap is in the correct port of the solenoid valve body (pg. 43).

17. QCD solenoid activates erratically or activates when no tagged specimen is passing through the QCD.

Cause: QCD threshold set too low.
Solution: Check threshold setting. If setting is lower than 10 change to 20 and retry. If erratic operation stops, retest to make sure tags can be detected at new setting.

Cause: Loose tags which have fallen out of the specimen are in the detection head and are loosened by a passing specimen or flowing water, causing the solenoid to activate.

Solution: Make sure tag placement depth is sufficient to keep tags from falling out of specimen. Inspect the QCD for any loose tags near the entry funnel and where the entry funnel connects to the detection head. Use water to flush inside of the detection head to remove any stray tags.

Cause: QCD Interconnect Cable is faulty.
Solution: Replace cable.

Cause: Interference from magnetic sources or power supply is being picked up by QCD.
Solutions: Check for sources of outside magnetic interference such as motors, generators, pumps etc. in the area. Position sources of interference farther from QCD if possible. If sources of interference must be close to QCD then position them perpendicular to the detection head rather than at the funnel or exit end. Check quality of power to Injector. Line noise on an AC line or voltage fluctuations from a generator can cause false QCD activations. Try increasing QCD threshold setting but be careful not to increase the threshold so high that tags can no longer be detected.

Cause: Electrical noise is being generated by improper AC power to Injector power supply.
Solution: In some instances we have found line power to be incorrectly supplied to a facility or tagging trailer. Usually problems have to do with incorrect grounding and wiring of the system. Improper installation of the U (3rd wire) ground has been a particular concern. A simple wire inspector trouble light can verify correct hook-up of the power outlet sockets. A voltmeter check to see if a potential difference exists between the wall outlet ground and nearby water pipe can also show if this is a problem.

Cause: Water may have gotten into the detector tube or its Blue Box.
Solution: Substitute a known-working QCD; if problem goes away return faulty QCD to NMT for repair.

18. Water leaks from the QCD's filter housing.

Cause: The filter housing is not tightened down properly or the gasket seal is damaged.

Solution: Tighten the filter housing. If it's still leaking, remove the housing and inspect its gasket for wear. Replace the gasket if necessary.

19. QCD reject count is negative.

Cause: The number of QCD activations has exceeded the number of Injector cycles (see [BATCH] pg. 14).
Solution: Remember, the QCD does not count missed tags but rather determines this number by subtracting QCD activations from Injector cycles. If the QCD has additional activations either from rechecking tagged specimens or by false activations from interference, then the QCD activations may exceed the number of Injector cycles and the reject count will be negative. For the same reason, if the Injector is intentionally cycled without tagging a specimen (for example during testing or setup) the number of rejects will be overstated. If you are using the QCD to recheck tagged specimens ignore the reject count

as it will not be accurate. If the QCD has false activations from interference correct the problem or ignore the reject count. Always reset the BATCH counts after setup or testing so that the beginning values are zero.

20. The display reads " RELOAD WIRE" .*

Cause: MK4b only. The Injector shut down improperly and has lost the position of the wire.

Solution: Press the [LOAD] key (pg. 15). Clear the Injector of any tags by running the the wire all the way out of the tip of the needle and wiping off the end of the wire. Press the [OK] key (pg. 17) and cycle the Injector once by pressing the [TAG] key (pg. 16), thus ejecting the initial large piece of wire out of the Injector . The MK4b is now ready to continue tagging specimens.

APPENDIX G: Spare Parts and Accessories

Spare Parts

The following items are recommended spare parts to have on hand. The operator should evaluate spare parts availability and delivery time when determining which spare parts to maintain for a particular operation. Most parts are available from stock with overnight delivery. However, any tagging operation which cannot tolerate 48 hours down time should maintain an adequate supply of critical spares. Also customers outside the U.S. must remember that shipping time and customs clearance can substantially increase the amount of time required to obtain emergency spares.

1 Cutter
1 Needle Package
1 Interconnect Cable
1 QCD Solenoid
1 Set Drive Rollers
1 QCD Filter Screen with Gasket

Accessories

The following accessories for use with the Model MKIV Tagging Unit are available from NMT:

Transit Cases	- For equipment which is used in many locations.
Battery Adapter Cable	- For tagging using battery power.

APPENDIX H: Specifications

Tag Injector

Dimensions:	11” (28cm) x 10” (25cm) x 8” (22cm) (l x w x h)
Weight :	17 lb. (8 kg)
Power requirement:	12 to 28 VDC, 50 watts maximum (with Separator Jet QCD) *Power supplied from QCD Black box for units with a Mechanical Gate QCD*
Temperature range:	Operating 32 ºF to 122 ºF (0 ºC to 50 ºC)

Quality Control Device

Dimensions:	35”(81cm) x 9”(24cm) x 9”(24cm) (l x w x h) w/o funnel, legs folded
Weight :	39lb (18kg)
Power requirement:	*Separator Jet QCD -- Power supplied through the Injector* 24 VDC, 50 watts maximum (mechanical Gate QCD)
Temperature range:	Operating 32 ºF to 122º F (0 ºC to 50 ºC)

Power Supply - As provided by NMT

Dimensions:	6.5 in. (165mm) x 4 in. (102mm) x 2 in. (51mm) (l x w x h)
Weight:	2.6 lb
Input:	100-250 VAC, 50/60hz
Output:	24 VDC

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CONTACTING NMT

NMT strives to provide the highest quality tagging systems for research and management. We offer free consultation on the suitability of available methods for specific purposes. Please visit our web site at **http://www.nmt.us**

Corporate Office

For information on prices, delivery times, and for assistance on any questions or problems relating to our equipment, please contact our main office:

Northwest Marine Technology, Inc.
Corporate Office
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Shaw Island, WA 98286, U.S.A.
Telephone: (360) 468-3375, FAX: (360) 468-3844
Sales e-mail: office@nmt.us
Tech Support email: techsupport@nmt.us.

Biological Services Office

For biological questions relating to the suitability of methods for various species and life stages, please contact our biological services office:

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955 Malin Lane SW
Tumwater, WA 98501
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AutoFish System Office

For AutoFish System equipment, parts and technical support, please contact our AutoFish System office:

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AutoFish System Office
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Anacortes, WA 98221
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Asia

For orders and inquires on equipment and supplies to be used in Asia, please contact:

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