Torque Verification Cart
Operations Manual

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Torque Cart: Introduction

The AIMCO/AcraDyne Torque Validation Cart is a mobile torque validation device used in automotive, aerospace and other manufacturing plants globally. The Cart houses repeatable joints and provides torque analysis and data for assembly tool verification purposes. The software included generates reports to assist manufacturing personnel with selecting and maintaining tools for their assembly processes.

The AcraDyne Torque Validation Cart is a comprehensive instrument for verifying and analyzing all types of assembly tools, including continuous drive, pulse tools, static torque wrenches, and click-type wrenches. The "torque analyzer" on the Cart is either an embedded or laptop PC. A comprehensive database of all tools along with their performance data and history is stored and accessible at all times.

The Torque Cart's database can reside local on the cart's computer or on a plant network.

The Torque Cart is available in several models which include a drivable model, a power-assist model, and a "push" model.

The cart with the laptop option provides a secure lockdown plate. The cart with the embedded computer / touch screen option allows for quick navigation without the need to use a touch pad or mouse. The torque measurement equipment included with the Cart includes joint simulators and rotary torque transducers with capability from 1-1000 Nm.

When the operator chooses a tool from the database, the program suggests which transducer to use to verify that tool.

The database can be loaded with information on all of the tools in the plant. This database is keyed on the plant asset number / tool number, tool manufacturer, model and serial number. Additional information includes the tool type, operation number, operation name, transducer I.D., and the torque specification.

ToolsTrac software collects and stores detailed torque, angle, and pulse readings. When a number of specified rundowns are reached, the results of the test and user notations are displayed and subsequently archived.

A torque graph and printable report is available at the conclusion of each test. All data within the database may be purged, as required, based on date/age.

Torque Cart: Safety

Always wear company and government mandated personal protective equipment, including safety glasses/goggles, when working on or near the Torque Cart.

Make sure all guards, safety gates, and warning labels are in place prior to operating the Torque Cart.

Keep hands and clothing clear of all moving parts (even guarded parts) at all times.

Be aware of all “pinch” points before running power tools!

The Torque Cart should not be operated by any person or persons unless they have read and understand this manual, and have been given proper instruction on operation and safety.

Torque Cart: Installation

After un-crating the Torque Cart, inspect it for visual damage caused during shipment. AIMCO has taken the utmost care in packaging the equipment to ensure that it arrives in good condition. However, AIMCO cannot be responsible for damages that occur during shipping and handling. If the Torque Cart appears to have been damaged during shipment, contact the carrier and your AIMCO representative as soon as possible.

ELECTRICAL

Electrical Installation should only be performed by or under the close supervision of a qualified electrician.

Depending on the cart configuration, power to the cart should either be:

- 110 volt, single phase, 60 Hz, 50 Hz, 15amps

OR

- 220 volt, single phase, 60Hz or 50Hz

Verify AC/charger rectifier is in the correct voltage position before connecting to power source.

Whenever the Torque Cart is not being used, it should be plugged in to an electrical outlet to ensure full battery charge.

TRANSPORTATION

The Torque Cart is mounted on a battery-powered chassis operating at 24V DC. See section on Parts Caddy for more detailed information.

Torque Cart: Warranty

AIMCO warrants, to the original purchaser, that the device will be free from defects in material and workmanship for a period not to exceed one (1) year from the date of the purchase (warranty period).

Any parts that are determined by AIMCO to be defective during the warranty period will be repaired or replaced at AIMCO's sole discretion, free of charge (F.O.B. AIMCO).

This warranty does not cover damage or failure that is determined by AIMCO to be the result of abuse, intentional misuse or use of the cart in any application other than the one for which it was designed.

AIMCO will not be responsible for repairs made in the purchaser's plant by non-authorized personnel, without prior written consent.

Repair or replacement of the device or its components is the exclusive remedy to the costumer. No other expressed or implied warranties exist, including warranties or merchantability or fitness for a particular purpose.

In no event shall AIMCO be liable for consequential or incidental damages.

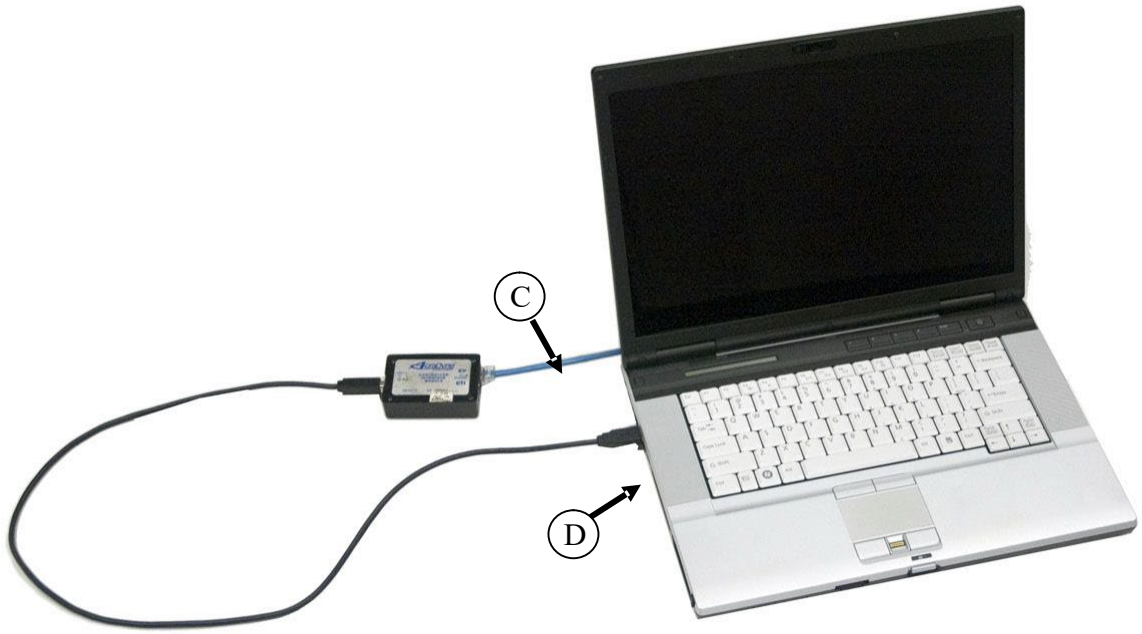
Torque Cart: Set-up Procedures

Installing the Computer

1. Laptop Option:
   A. Secure the laptop into the holder to prevent damage.
   B. Plug the power cable into the back of the laptop.
   C. Plug the RJ-45 network cable into the CAN-dongle
   D. Plug the USB cable into a USB port on the laptop

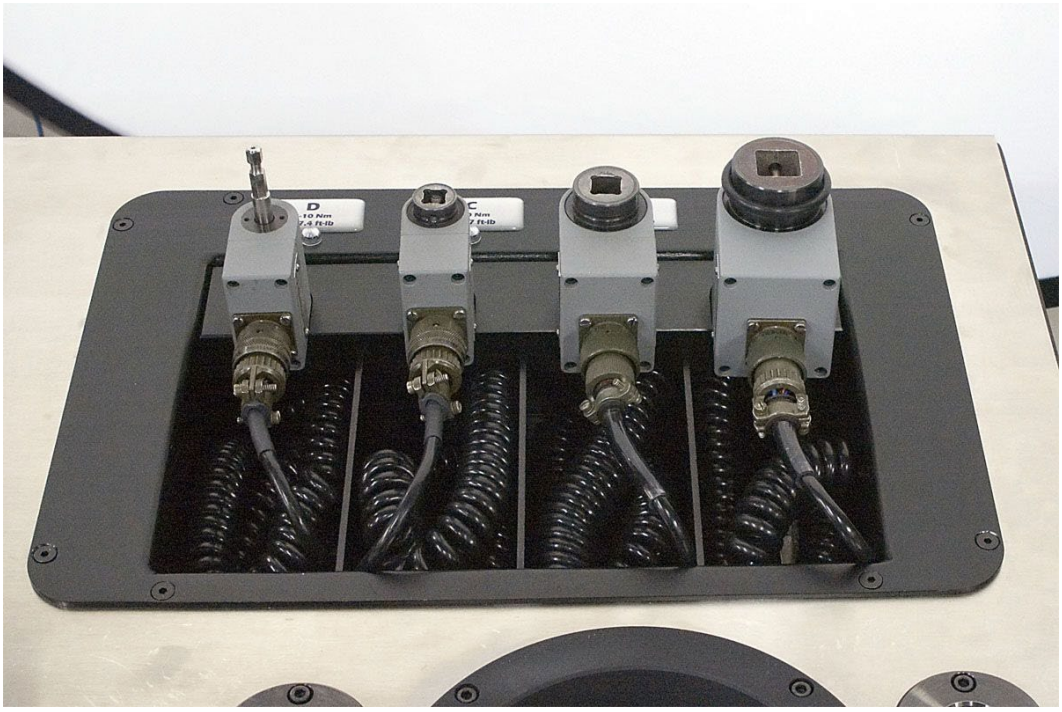
   Embedded Option:
   A. Verify Touch Screen secured to Cart.
   B. Verify RJ-45 network cable plugged into CAN-dongle (**C**), located inside cart below the transducers.
   C. Verify USB cable (**D**) is plugged into embedded PC, located inside cart below the transducers.
2. Connect transducers
3. Make sure Torque Cart's electronics are in the 'on' (clockwise) position.
4. Press the power button on the laptop keyboard to start the computer. The touch screen option will automatically turn on when the cart electronics are turned on.

   Note: For the touch screen option, when the cart electronics are turned off, the computer will continue to stay on for approximately 1-2 minutes if it was not shut down through Windows.
5. Launch ToolsTrac by double-clicking the ToolsTrac icon on the desktop.



Connecting the Transducers

1. Transducers are mounted in the transducer tray.
2. Note the labels on the transducers and the corresponding labels on the front of the joint simulator. Place the male square drive of the proper transducer into the female square drive of the appropriate socket.
3. Install the other three transducers in a similar manner.
4. Plug in each transducer cable into the connection under each corresponding socket inside the tray.



Torque Cart: Connecting Tools to transducer

Connecting Power Tools - Using Onboard Joint Simulators
(For pneumatic and electric tools)

1. Choose the transducer.
2. Make sure estimated tool torque output does not exceed the transducer maximum rating.
3. When possible; match the tool square drive size with the transducer square drive size, minimizing the use of adaptors.
4. Place the male square drive of the tool into the female square drive of the installed transducer.
5. If ToolsTrac is set up for the tool, a green LED light above the proper transducer will indicate the correct selection.

Note: Power tools require rotation before reaching torque for proper measurement. The joint simulators provide a consistent angle of rotation for testing power tools.

Connecting Power Tools - Using Transducers on Applications
(For pneumatic and electric tools)

1. Choose the transducer.
2. Make sure the estimated tool torque output does not exceed the transducer maximum rating.
3. When possible, match the tool square drive size with the transducer square drive size, to minimize the usage of adaptors.
4. Place the male square drive of the tool into the female square drive of the transducer.
5. Place proper socket for application onto the male square drive of the transducer.
6. Place the socket on the application on which tool will be tested.
7. If ToolsTrac is configured for using tool on an application the green LED light will indicate suggested transducer.
8. If the transducer cable is not long enough to reach the application, a secondary extension cable may be used.

Note: Transducers on this cart are designed so that they can be used on actual assembly applications. Please be aware that part and process variations will effect the repeatability of torque, angle and or pulse count data. The Cp & Cpk values will never be as good on applications as they are when testing tools on test joints.

Connecting Hand Tools – Using Static Joint Plate
(For click wrenches, dial wrenches, digital wrenches and transducerized wrenches.)

1. Choose the transducer.
2. Make sure estimated tool torque output does not exceed the transducer maximum rating.
3. When possible, match the tool square drive size with the transducer square drive size minimizing the use of adaptors.
4. Place the male square drive of the tool into the female square drive of the transducer.
5. Place the male square drive of the transducer into the appropriate square drive receptacle on the adapter plate. Best results will be achieved if wrench actuation or load is applied towards ground.

   Note: Hand tools do not require rotation before reaching torque for proper measurement. Use of square drives without joint simulators is sufficient for testing of hand tools.

ToolsTrac Installation:

Step 1: Installing AIMCO ToolsTrac Software

Note: Make sure the USB CAN-dongle is not connected to the computer during installation. You may plug it back in after installation of ToolsTrac is complete.

1. Insert the media MemoryStick/CD labeled "ToolsTrac" (Media is Provided)
2. Double click the file "ToolsTrac.msi"
3. Depending on the status of the PC, you may need to click "Accept" on one or more "License Agreement" windows to install ToolsTrac dependencies.
4. Follow the installation wizard by clicking "Next" in all subsequent windows.
5. Click the "Finish" button to complete installation.

NOTE: When re-installing ToolsTrac or installing another version you must go to Start →Control Panel→Add / Remove Programs →Select ToolsTrac and perform an uninstall before installation of new version.

Local Database Installation:

If there is a SQL Server 2005 Instance and it is already installed in the Sytem Please go to next step.

Step 2: Installing SQL Server 2008 Express

1. Download SQL Express 2008 from:

   http://www.microsoft.com/sqlserver/2008/en/us/express.aspx

   And save it to your hard disk.

   Note: for Windows XP, Double click the file "SQLEXPRWT_x86_ENU.exe"
2. Select "New Installation"
3. Check the "I accept the License terms"
4. Click "Next" Button
5. Setup will run.
6. In the Feature Selection window click "Next"
7. In the Instance Configuration window click "Next"
8. In the Server Configuration window select "NT AUTHORITY\NETWORK Service" and click "Next"
9. In the Database Window under Configuration
   a. For Authentication Mode, Select "Mixed Mode"
   b. Enter "sql_admin" for Password, without quotes, and Confirm Password.
10. Follow the wizard by clicking "Next" in all other windows.
11. Wait for the installation to complete
12. You will receive a message stating "SQL Server R2 installation Completed successfully".

Step 3: Creating ToolsTrac database and database user

1. Open start->Programs->SQL Server 2008 R2->SQL Server Management Studio.
2. Make sure "Windows Authentication" is selected for authentication.
3. Click "Connect"
4. File->Open->File-> "C:\Program Files\Aimco\ToolsTrac\Database Scripts\ToolsTrac_seed_data_en_MX" for Spanish database and "C:\Program Files\Aimco\ToolsTrac\Database Scripts\ToolsTrac_seed_data_en_US" for English database.
5. Press "! Execute" or "Query->Execute" in the menu.

ToolsTrac is now ready to be used. Just double click the Icon "ToolsTrac" on the desktop and use it.

Note:
If you have Changed the SQL Server Instance Name in Step 2.7 then you need to follow the steps below.

1. Locate the ToolsTrac.exe.config file. It is in the ToolsTrac Intall Directory (C:\Program Files\Aimco\ToolsTrac)
2. Right click on the file, select open with and select WordPad. If neither shows up under the menu, select the "Choose program…" option and select WordPad. Or if you prefer, you may use your own choice of editor, one that is meant for HTML/XML is recommended if possible
3. You will see a section Labeled <connectionStrings>
4. You will see a section under connectionStrings that looks similar to this example:

```
<add name="ToolsTrac.Properties.Settings.TOOLSTRACConnectionString"
connectionString="Data Source=./SQLEXPRESS; Initial Catalog=TOOLSTRAC;
Persist Security Info=True; User ID=toolstrac; Password=server"
providerName="System.Data.SqlClient" />
```

Replace "**Data Source**=./SQLEXPRESS" with " **Data Source**=./Instance Name" Instance Name is the Instance name you entered in step 2.7.

5. Save and close the file.

Centralized Database Installation

For the Server:

1. Installation of SQL Server Express is not recommended. It is recommended to install the full version of SQL Server on the server machine in-order to make maximum use of your setup.
2. ToolsTrac requires Microsoft SQL Server Professional or Enterprise, unless it is a local installation only, which allows for Microsoft SQL Server Express.

For the Client:

1. Navigate the Start Menu to My Computer
2. Go to C:\Program Files\Aimco\ToolsTrac
3. Locate the ToolsTrac.exe.config file.
4. Right click on the file, select open with and select WordPad. If neither shows up under the menu, select the "Choose program…" option and select WordPad. Or if you prefer, you may use your own choice of editor, one that is meant for HTML/XML is recommended if possible
5. You will see a section Labeled <connectionStrings>
6. You will see a section under connectionStrings that looks similar to this example:

```
<add name="ToolsTrac.Properties.Settings.TOOLSTRACConnectionString"
connectionString="Data Source=SERVERNAME\INSTANCE; Initial
Catalog=TOOLSTRAC; Persist Security Info=True; User ID=USERNAME;
Password=PASSWORD" providerName="System.Data.SqlClient" />
```

7. Change SERVERNAME to your central server's name or IP address. If the server has a named instance, change INSTANCE to the servers instance name, otherwise leave out the \INSTANCE part.
8. Change TOOLSTRAC in "Initial Catalog=TOOLSTRAC" to the name of the database in the SQL server.
9. Change USERNAME to the login username of the SQL server, and PASSWORD to the login password.
10. Examples are listed below:

If …

- The server's name on the network is "TTServ"
- Running a default installation of SQL Server Pro
- The username is "toolstrac" and the password is "server"
- The database is loaded and was not renamed from TOOLSTRAC

The configuration line should look similar to this:

```
<add name="ToolsTrac.Properties.Settings.TOOLSTRACConnectionString"
connectionString="Data Source=TTServ; Initial Catalog=TOOLSTRAC;
Persist Security Info=True; User ID=toolstrac; Password=server"
providerName="System.Data.SqlClient" />
```

If …

- The server's name on the network is "TTServ"
- The SQL instance name is "SHOP1"
- The username is "toolstrac" and the password is "server"
- The database is loaded and was renamed to NORTHTRAC

The configuration line should look similar to this:

```
<add name="ToolsTrac.Properties.Settings.TOOLSTRACConnectionString"
connectionString="Data Source=TTServ\SHOP1; Initial Catalog=NORTHTRAC;
Persist Security Info=True; User ID=toolstrac; Password=server"
providerName="System.Data.SqlClient" />
```

Logging In

1. Obtain your login password from your administrator.
2. Open ToolsTrac by double clicking the icon on the desktop.
3. Type your username in the **User Name** field.
4. Type your password in the **Password** field.
5. Press the **Ok** button or press **Enter** on your keyboard.

   Note: If you have not registered ToolsTrac, just click Ok to login.

   Note: If your trial period has expired, or if you wish to register ToolsTrac click the **Register** button, call AIMCO Customer Service and provide the code given in the ToolsTrac Registration window. When you are provided with the Serial from customer service, type it in the boxes under **Serial**. This Serial number will only work on the system for which the code has been given.

Security Levels

There are four different security levels for ToolsTrac

a. View - May only view records and print reports ; May **not** run torque verification

b. Advanced User - May only view records and print reports ; May run torque verification

c. Power User - May add, edit, and delete records and print reports. ; May run torque verification

d. Administrator - An Administrator has full permission to perform any action allowed in ToolsTrac ; Change users/accounts ; Advanced settings: change alerts, configure lookups

Changing Passwords

To change current user's password:

1. After logging in
2. Click on **System Administration** from the top pull-down menu.
3. Click on **Change Password** in the pull-down menu.
4. Type the current password in the **Old Password** field.
5. Type your new password in the **New Password** field.
6. Confirm your new password by typing your new password again in the **Confirm Password** field.
7. Click **Save** to finish changing your new password.

To change a User's Password (must be Administrator):

1. Click on **System Administration** from the top pull-down menu.
2. Click on **Users** in the pull-down menu.
3. Select the user from the table which you'd like to change the password for.
4. Click the **Edit** button on the bottom of the window.
5. Type the new password in the **New Password** field.
6. Confirm the new password by typing the new password again in the **Confirm Password** field.
7. Click **Update** to change the password.

Adding / Editing User Accounts

New User:

1. Click on **System Administration** from the top pull-down menu.
2. Click on **Users** in the pull-down menu.
3. Click the **Add** button.
4. Make sure to enter a Username, Password, Confirm the password, First Name and Last Name. All other fields are optional.
5. Click **Add** button to finish adding the new user.

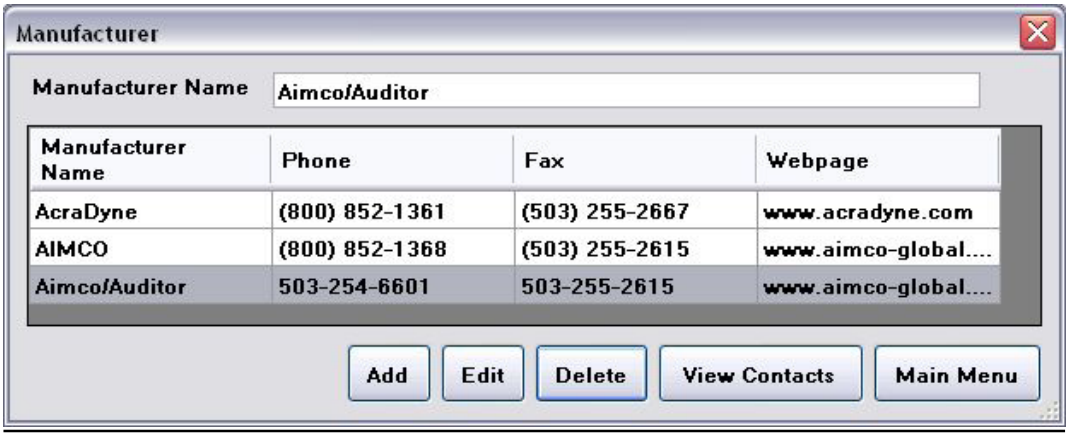
Editing a User Account:

1. Click on **System Administration** from the top pull-down menu.
2. Click on **Users** in the pull-down menu.
3. Select the user from the table which you'd like to change.
4. Click the **Edit** button on the bottom of the window.
5. Change the information that you wish to update.
6. Click **Update** to save changes.

Adding / Editing / Removing Inventory and Information

Manufacturers:

1. Click on **Configure** from the main screen's top pull-down menu.
2. Click on **Manufacturer** in the pull-down menu.



Adding a Manufacturer:

a) Click the **Add** button on the bottom of the window.

b) Enter the manufacturer's information. (Note: Only the manufacturer's name is required)

c) Click **Add** to save the manufacturer.

d) (The window will stay open in-case you need to change the information just entered. You may press **update** to save any changes)

Editing a Manufacturer:

a) Select the Manufacturer from the list that you wish to change.

b) Click the **Edit** button on the bottom of the window.

c) Change the information that you wish to update.

d) Click **Update** to save changes.

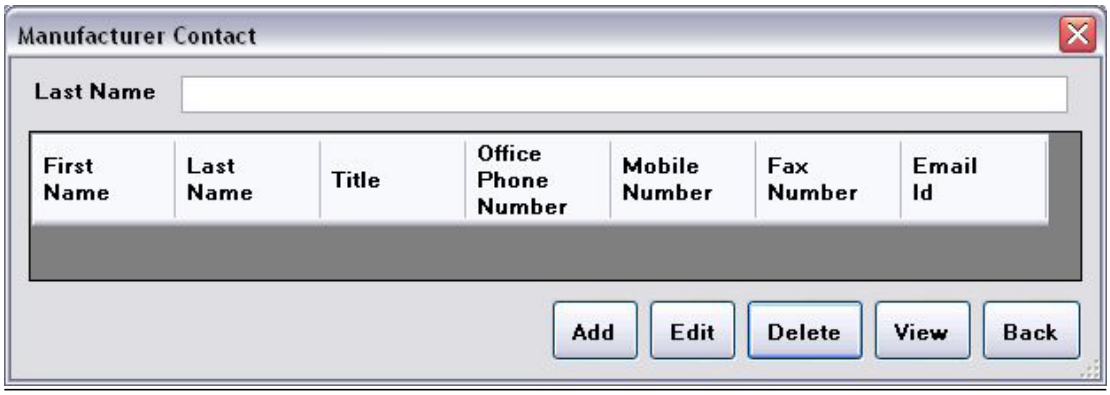
Deleting a Manufacturer:

a) Select the Manufacturer from the list that you wish to delete.

b) Click the **Delete** button on the bottom of the window.

c) A popup will appear, verifying that you wish to delete the record.

d) If you are sure you wish to delete the record, click the **Yes** button.



Viewing and Editing Contacts:

e) Select the Manufacturer from the list that you wish to view contacts for.

f) Click the **View Contacts** button on the bottom of the window.

g) A new window will appear listing the contacts for that manufacturer.

h) You may Add, Edit and Delete Contacts just as you would manufacturers.

Suppliers:

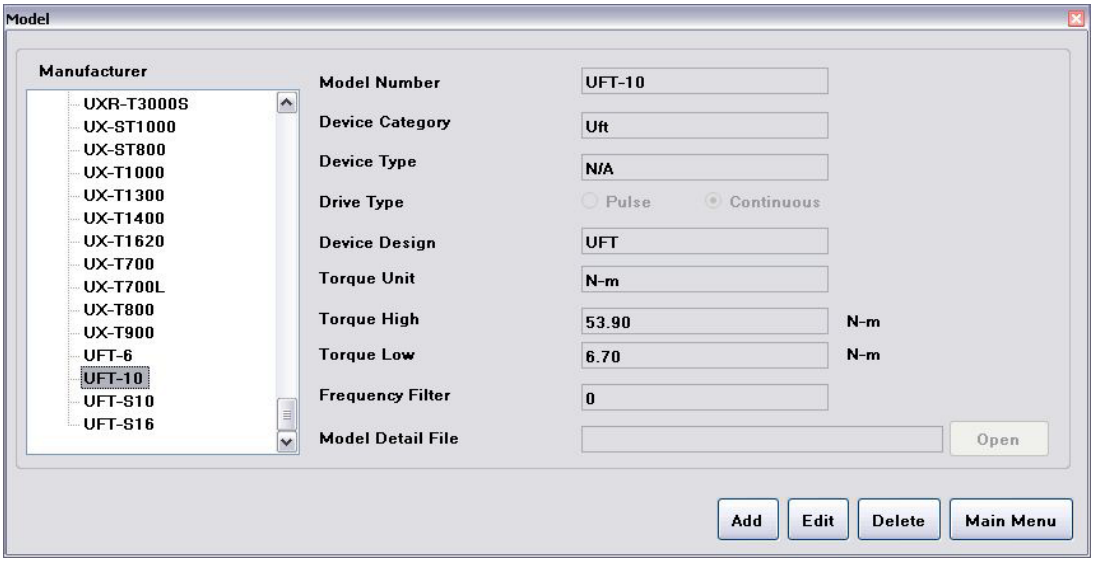
Procedures are the same as that of Manufacturers. Just Select **Supplier** from the **Configure menu** on the main screen instead.

Tip: You may also choose to only view detailed information by clicking the **View** buttons for any of these menus. This will protect your asset information from being changed accidently.

Note: Users who have a security level of **View** will only have access to the **View** buttons.

Device Models:

1. Click on **Configure** from the top pull-down menu.
2. Click on **Model** in the pull-down menu.



Adding a New Model:

a) Click the **Add** button on the bottom of the window.

b) Enter the model information. The Manufacturer Name, Model Number, Device Category, Device Type, Device Design, Pulse/Continuous, Torque Unit, Torque High, Torque Low, and Frequency Filter are all required fields.
Note: Torque high and low reflects usable range of the tool not test specification limits.

c) Click **Add** to save the model.

d) (The window will stay open in-case you need to change the information just entered. You may press **update** to save any changes)

Editing a Model:

a) Select the Manufacturer from the drop down list.

b) Select the Model you wish to change.

c) Click the **Edit** button on the bottom of the window.

d) Change the information that you wish to update.

e) Click **Update** to save changes.

Deleting a Model:

a) Select the Manufacturer from the drop down list.

b) Select the Model you wish to delete.

c) Click the **Delete** button on the bottom of the window.

d) A popup will appear, verifying that you wish to delete the record.

e) If you are sure you wish to delete the record, click the **Yes** button.

Tip: You may also choose to only view this by clicking the **View** button from the main Model Menu. This will protect your device information from being changed accidently.

Note: Users who have a security level of **View** will only have access to the **View** button.

Assets:

ToolsTrac was designed to keep track of a variety of inventory. There are 4 device types that ToolsTrac specifically handles: Tools, Torque Carts, Transducers, and Joint Simulators.

On the Main screen there are two shortcut buttons for Assets: The **Device Inventory** button pulls up the inventory screen for all devices. The **Tool Inventory** button pulls up the inventory screen for only tools.

You may also select **Inventory** from the top pull-down menu, select **Device**, and select **All**, or select the specific category you wish to manage.

Choosing the **Export Inventory Detail** button will allow you to export your device inventory to a comma separated (CSV), tab separated (TSV), or XML spreadsheet which can be opened in Microsoft Excel.

	Descriptio	Manufactu	Model No	Serial No	Category	Type	Design	High Tq Capacity	Low Tq Capacity	Torque Unit	Frequency Filter	Location
1400TA	1400TA	AIMCO/...	ARTIS-1...	56494721	Transdu...	DC	Rotativo	1400.00	1.00	N-m	0	Plant
15nm-tool	15nm-tool	AcraDyne	AEN120...	123456...	Herrami...	DC	Cabeza ...	15.00	3.00	N-m	500	Plant
180TA	180TA	AIMCO/...	ARTIS-5...	564647	Transdu...	DC	Rotativo	180.00	1.00	N-m	0	Plant
20TA	20TA	AIMCO/...	ARTIS-2...	12345A...	Transdu...	DC	Rotativo	20.00	1.00	N-m	0	Plant

Adding a Tool (Must be done from **Tool** or **All** Menus):

a) Click the **Add** button on the bottom of the window.

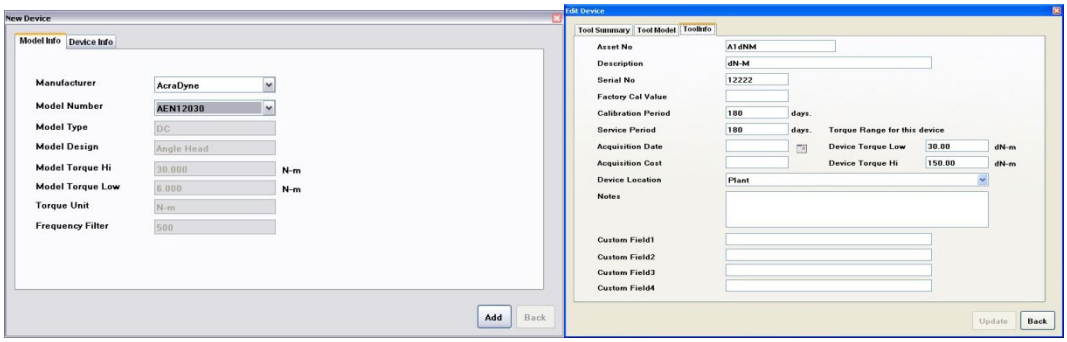
b) Select the Manufacturer and Model Number from the drop down menus. If the Manufacturer/Model is not listed, see *Adding a New Model* section.

c) Click the **Device Info** tab

d) Enter the information listed. Only an Asset Number is required, however it is recommended you fill out as much information as possible.

e) (The window will stay open in-case you need to change the information just entered. You may press **update** to save any changes)

f) Then Click the **Back** button.



Note: Any enabled Custom Fields will appear below the Notes field.

Editing a Tool:

a) Select the tool you wish to change.

b) Click the **Edit** button on the bottom of the window.

c) Make the desired changes. **Note**: The *Summary* page cannot be modified.

d) Click the **Update** button to save any changes.

e) Then Click the **Back** button.

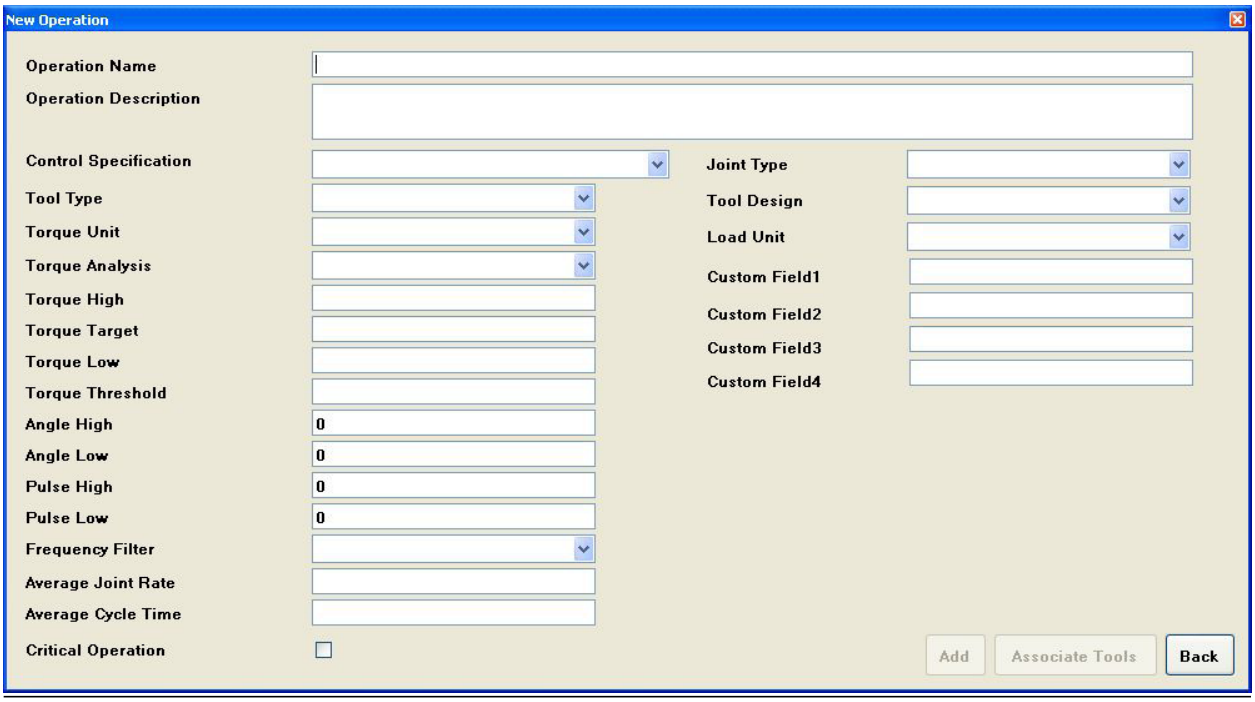
Tip: You may also choose to only view this by clicking the **View** button from the main Device Menus. This will protect your asset information from being changed accidently.

Note: Users who have a security level of **View** will only have access to the **View** button.

Tool Operations:

ToolsTrac supports tool operations. You can associate any number of tools to an operation for which they will perform. An asset may be applied to multiple operations simultaneously.

1. Click on **Configure** from the top pull-down menu.
2. Click on **Operation** in the pull-down menu.



Adding a New Operation:

a) Click the **Add** button on the bottom of the window.

b) Enter the Operation Information. The Operation Name, Control Specification, Joint Type, Tool Type, Tool Design, Torque Unit and Frequency filter fields are all required.

c) Click **Add** to save the Operation.

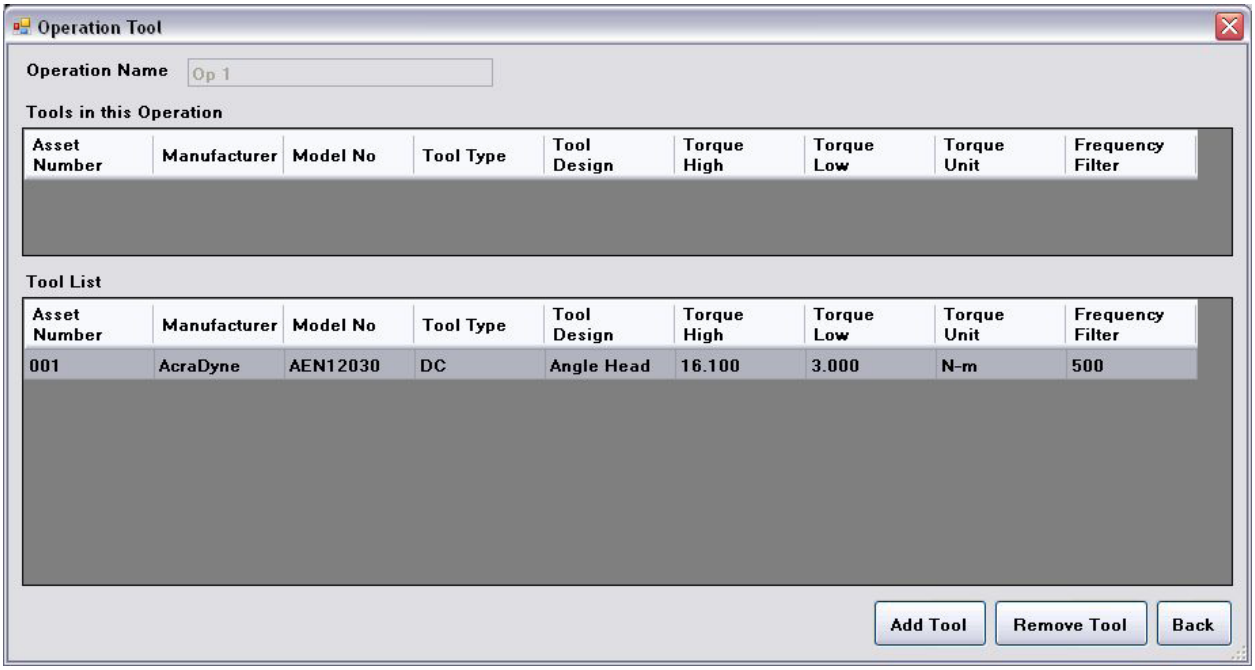
d) (The window will stay open in-case you need to change the information just entered. You may press **update** to save any changes.

Note: The Torque High must be greater than Torque Low. The Torque Target must be in-between Low and High.

Note: If the operation does not specify an angle high/low or a pulse count high/low, just leave these values at 0. This is important in-order to provide correct statistical values.

Note: The Torque High/Low and Target values are used for statistical analysis and Torque Verification, so it is important to provide correct values. This is also true of Angle High/Low and Pulse High/Low if they are to be used for statistical analysis.

Note: Any custom fields will display below the **Load Unit** field.



Associating Tools to an Operation:

a) Choose the operation you wish to associate a tool with.

b) Click **Edit** button from the bottom of the window.

c) Click **Associate Tools** from the bottom of the window.

d) Select the tool, from the "Tool List" at the bottom, which you wish to associate with the operation.

e) Click **Add Tool** at the bottom of the window to add it to the tools associated with the operation.

f) Then Click the **Back** button when you are done.

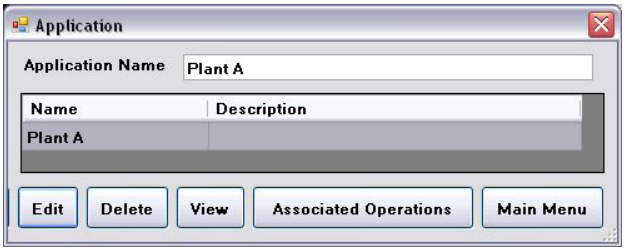
Tip: You may also choose to only view this by clicking the **View** button from the main Operation Menu. This will protect your operation information from being changed accidently.

Note: Users who have a security level of **View** will only have access to the **View** button.

Associating Operations to Applications:

ToolsTrac also supports Applications. This allows operations to be organized further into applications. This might be used to separate different manufacturing models, manufacturing plants, etc.

1. Click on **Configure** from the top pull-down menu.
2. Click on **Application** in the pull-down menu.



Adding a New Application:

a) Click the **Add** button on the bottom of the window.

b) Enter the Application Information. The Application Name is the only required field.

c) ToolsTrac will then prompt if you want to Associate Operations now. If you wish to do so then click the **Yes** button, and follow directions for *Associating Operations to an Application* from **step d**.

Associating Operations to an Application:

a) Select the Application you wish to associate operations to.

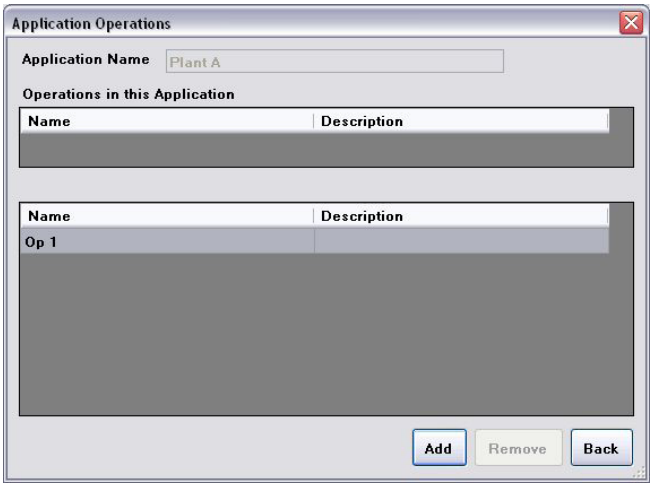
b) Click the **Edit** button at the bottom.

c) Click the **Associate Operations** button in the new window.

d) Select the operation from the Operations List at the bottom of the screen that you'd like to associate.

e) Click the **Add** button at the bottom to add the Operation to the Application.

f) Click the **Back** button when you are done.

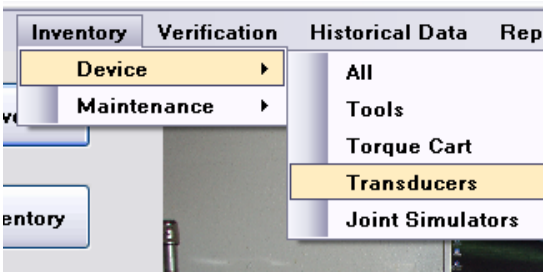


Setting up and Configuring Transducers

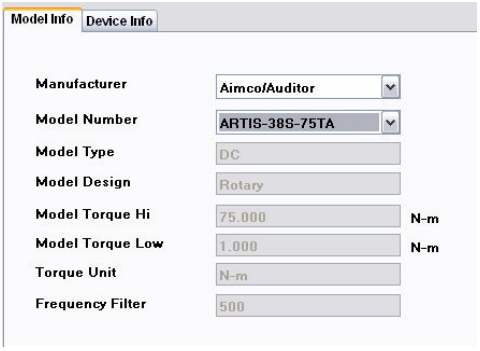
Note:

- This must be done before automatic (or manual data entry) verification will work.
- Also, the appropriate Transducer model must be in the system under models.

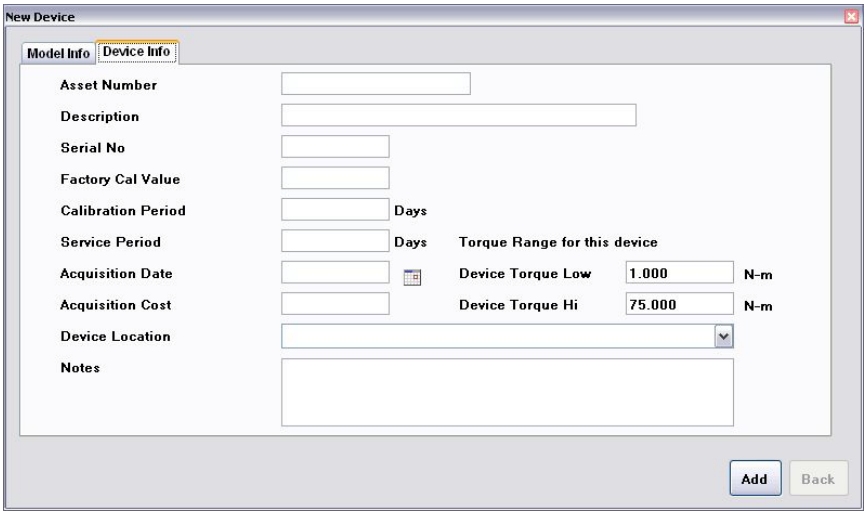
1. Click on **Inventory** from the top pull-down menu.
2. Click on **Device** in the pull-down menu.
3. Click on **Transducers** in the **Device** pull-down menu.



4. Click on the **Add** button at the bottom.
5. Select the *Manufacturer* and *Model* of transducer from the drop-down menus.
6. Select the **Device Info** Tab.
7. Make sure to enter an *Asset Number*.
8. Make sure the *Device Torque Low* and *Device Torque Hi* are entered according to the transducer manufacturer's specification in order to get proper readings from the transducer.



9. Make sure to enter a *Factory Cal Value*. If you do not know what it is, then choose 1.0 for now, and see the section on calibrating a transducer.
10. Click the **Add** button.
11. Then Click the **Back** button when you are done.



Setting up and Configuring a Torque Cart

Note:

- This must be done before automatic or manual verification will work.
- Also, transducer(s) must be added to the inventory.

1. Click on **Inventory** from the top pull-down menu.
2. Click on **Device** in the pull-down menu.
3. Click on **Torque Cart** in the **Device** pull-down menu.

Adding a Torque Cart:

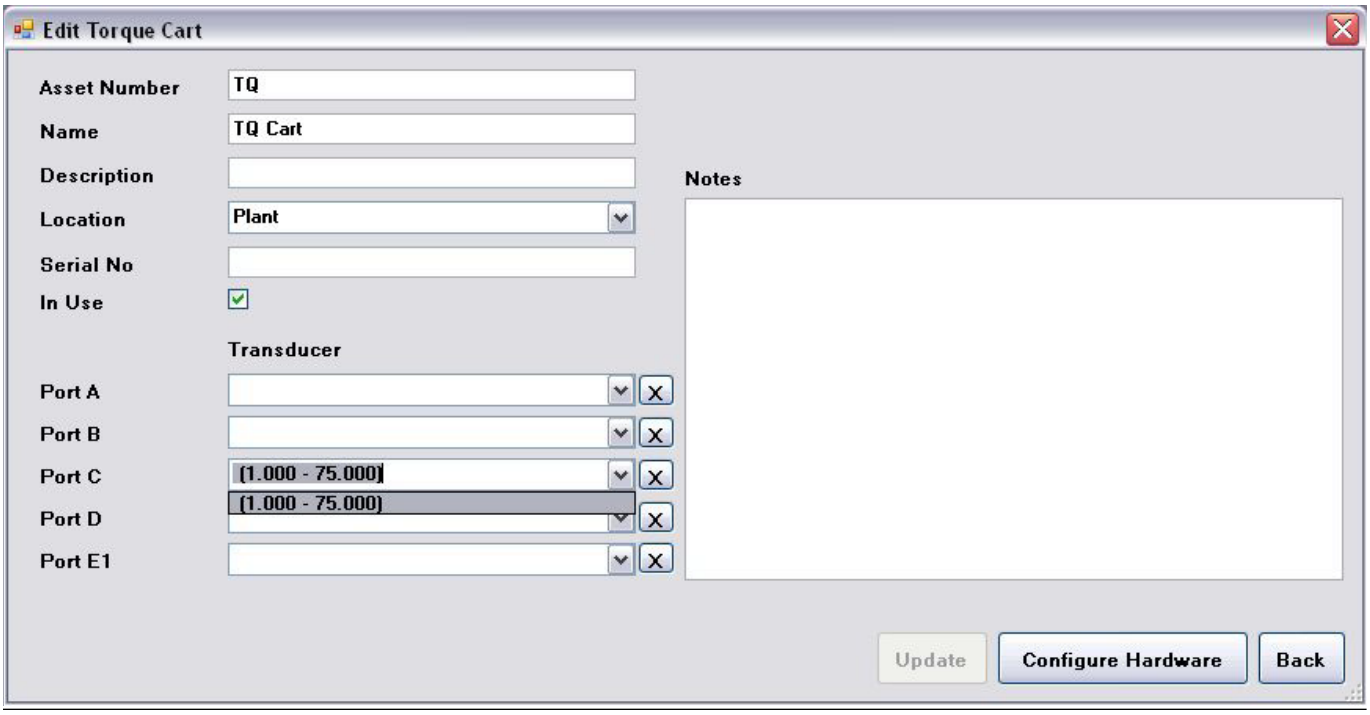
a) Click the **Add** button at the bottom.

b) Enter the *Asset Number* and *Name*.

c) In order for automatic verification to work, you must choose at least 1 transducer for one of the ports on the torque cart.

d) Click the Add button to add the Torque Cart to your inventory.

Note: Clicking the **X** button will clear the associated transducer port of [it's] selection.



Configuring a Torque Cart:

Note: The torque cart USB cable must be plugged into the computer.

a) Select the Torque Cart you wish to configure.

b) Click the **Edit** button at the bottom.

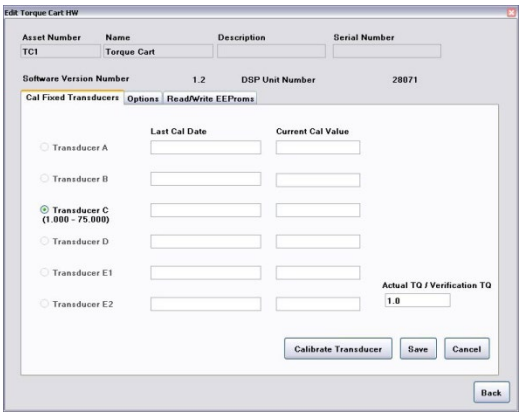
c) Click the **Configure Hardware** button. You will see each of the green status lights light up on the Torque Cart.

Note: Once this screen pops-up, you may click back if you wish to use the default configuration settings. Your torque cart will now be "Configured".

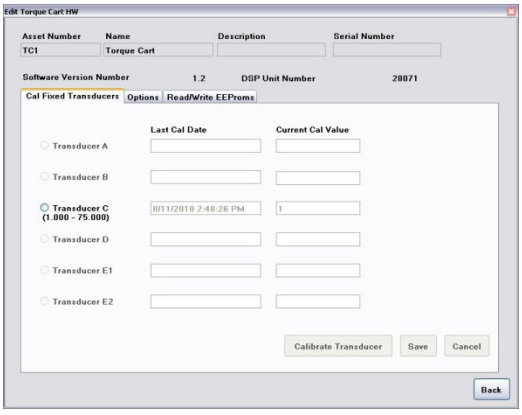
d) Select each Transducer being configured

e) Click the **Calibrate Transducer** button.

f) Enter the *Actual TQ / Verification TQ* for the Transducer. If you do not know it, then enter 1.0 and refer to the *Transducer Calibration* section



g) Click the **Save** button.



h) Repeat **steps d through g** until all transducers are configured.

i) **Options** and **Read/Write EEProms** Tabs.

a. There are options here that you may change. If you do not know how to use them, then it's best not to change anything here.

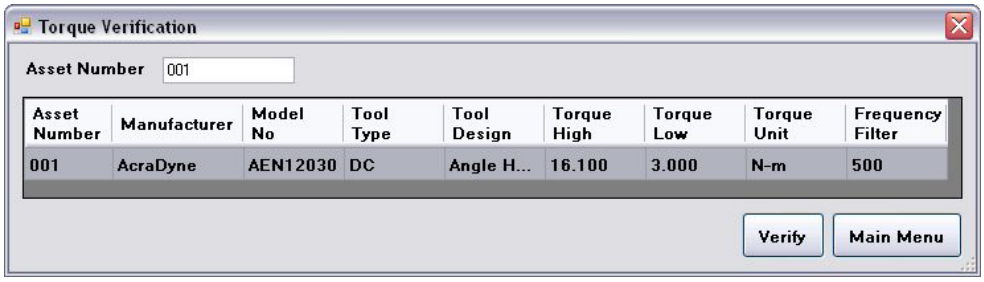
j) Click the **Back** button when you are done.

Tool Verification

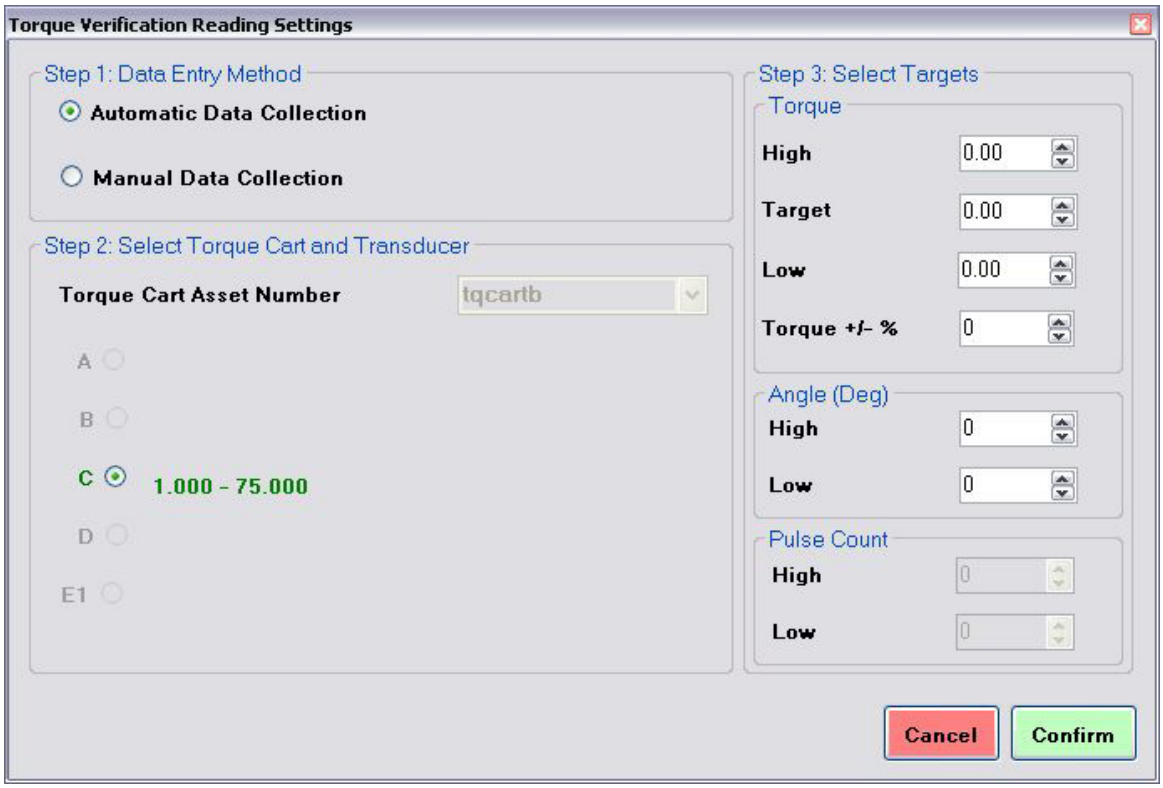
Note:

- A torque cart and transducer(s) must be added and configured before automatic verification can be used.
- Make sure the Transducer is hooked up to the Torque Cart in the appropriate port.

1. Click on **Verification** from the top pull-down menu.
2. Click on **Torque Verification** in the pull-down menu.
3. Select the tool from the list that you wish to run verification on.



4. Click the **Verify** button or double click the tool.



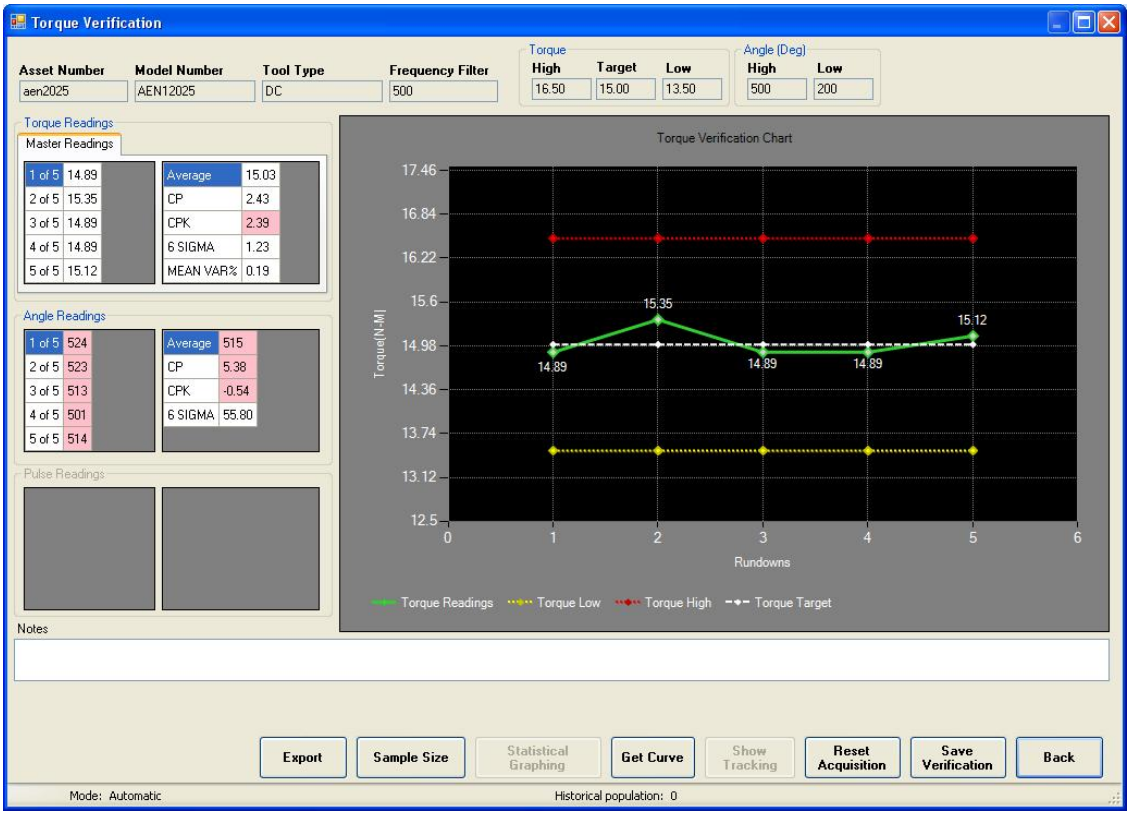
5. The Torque Verification Settings Window will pop up. Select the Transducer port for the appropriate transducer.

   Note: For step 3, only the Torque High & Target are required. Additional Targets may be selected.

   Note: The Torque +/- % selector will auto-populate the High/Low Torque Targets based off the Target Torque value selected.

6. Click the **Confirm** button.
7. The *Torque Verification Readings* Screen will pop up, and you're ready to take readings.

8. The Left Torque Readings Chart will display the samples' torque reading. The chart to the right displays the torque statistics for the sample. If an external transducer is used, another tab beside the Master Readings tab will display the External Transducer Readings and Statistics.
9. The Left Angle Readings Chart will display the samples' angle reading. The chart to the right displays the angle statistics for the sample.
10. The Left Pulse Readings Chart will display the samples' pulse count reading. The chart to the right displays pulse statistics for the sample.
11. The large chart will display the torque vs. sample number.



Note: If you left click on the Torque/Angle/Pulse readings in one of the cells, a popup will ask if you wish to delete the latest rundown.

Note: The Change Sample Size button and the ability to delete rundowns will be disabled upon saving the verification run.

Note: The Get Curve button will be available for all automatic verifications. If there are no rundowns for the verification, you will not be able to retrieve the last curve data.

Note: If you wish to save multiple verifications for the same tool without re-opening the window, after saving you may use the Reset Acquisition button to start a new verification with the same Torque High/Low and Target specifications.

Note: When changing the sample size from within this window it will not globally change the Sample Size; you are only changing sample size for the current test.

Note: Selecting the Export button will allow the rundown data, and tool/spec info to be exported to a comma separated (CSV), tab separated (TSV), or XML spreadsheet which can be opened in Microsoft Excel.

Viewing a Curve:

a) Click the **View Curve** button at the bottom.

b) The most recent torque and/or angle curve(s) rundown that is saved to the C:\Aimco\Curves directory, with proper naming scheme, will be automatically loaded for the appropriate asset.

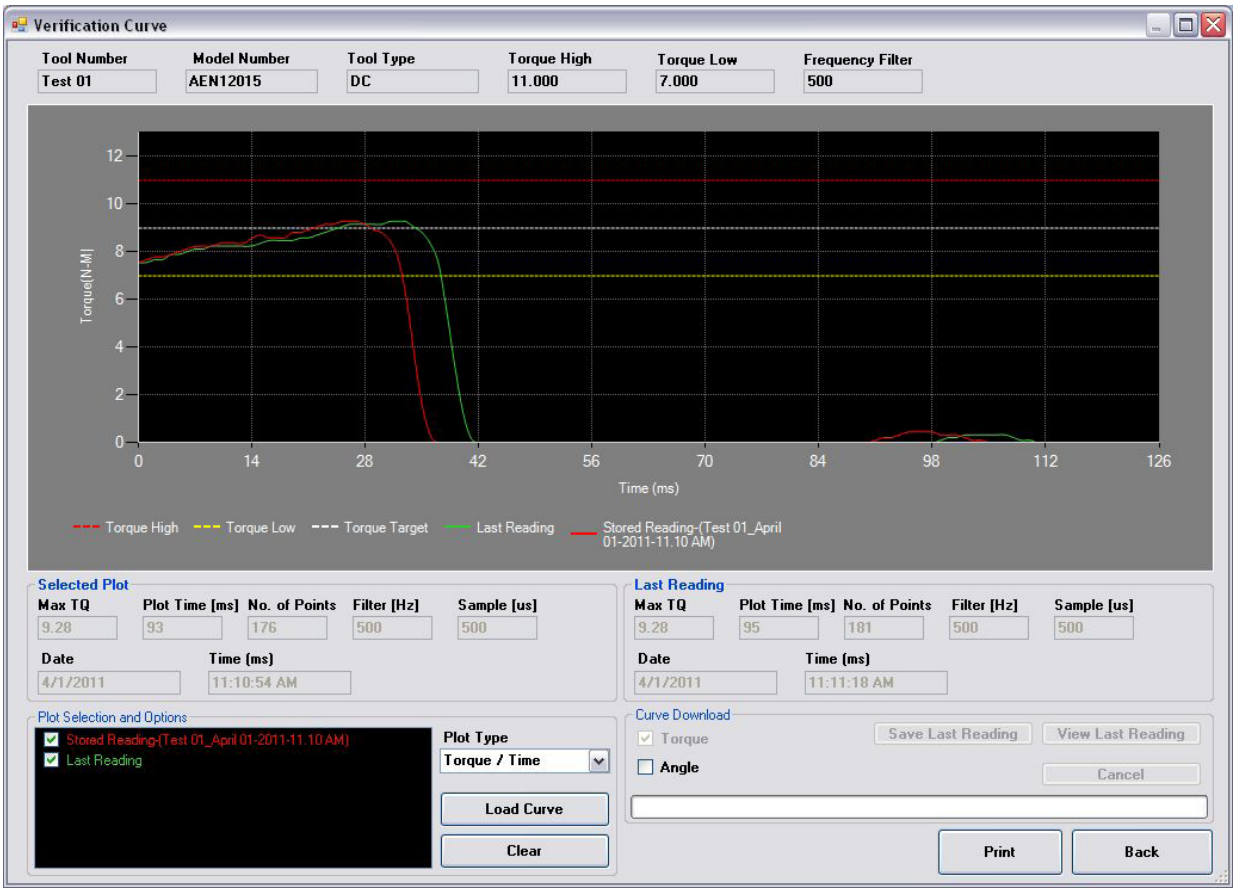
c) If you wish for angle data to be downloaded, select the Angle Checkbox first.

d) Click the **View Last Reading** button. This will take a few seconds to a few minutes to complete.

e) If you have selected Angle, there may be more graphs. You can select these under the **Plot Type** drop-down menu.

f) You may save the curve by clicking the **Save** button.

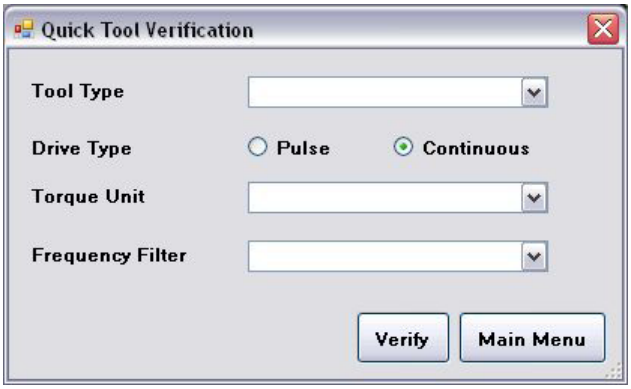
g) You may load a curve from file by selecting the **Load Curve** button. When prompted for the file, select either angle or torque file, it will load whatever is available for that curve. It is important the torque/angle file retain the same filename, with separate extensions. The Torque file is "**.T.dat"**, the angle file is "**.A.dat"**



Using the Quick Verification Tool

Note:

- A torque cart and transducer(s) must be added and configured before automatic verification can be used.
- Make sure the Transducer is hooked up to the Torque Cart in the appropriate port.
- Saving of Quick tool Verifications is not possible, if you wish to save verification info, be sure to run a regular tool or operation verification.



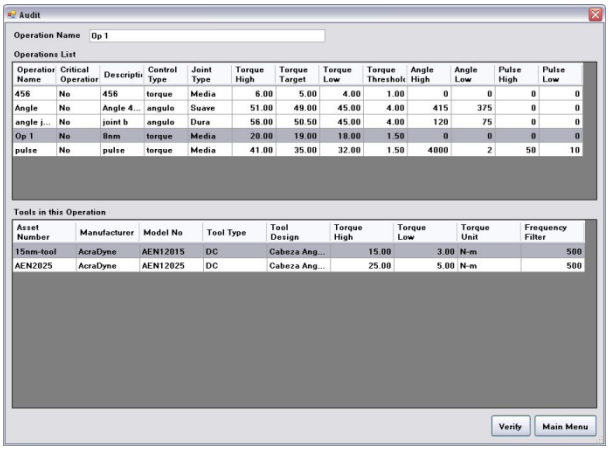
1. Click on **Verification** from the top pull-down menu.
2. Click on **Quick Tool Verification** in the pull-down menu.
3. Select the Tool Type, Torque Unit, Torque High, Torque Target, Torque Low and Frequency Filter. All fields are required.
4. Click the **Verify** button.
5. Refer to **step 5** of *Verification* for remaining instructions.

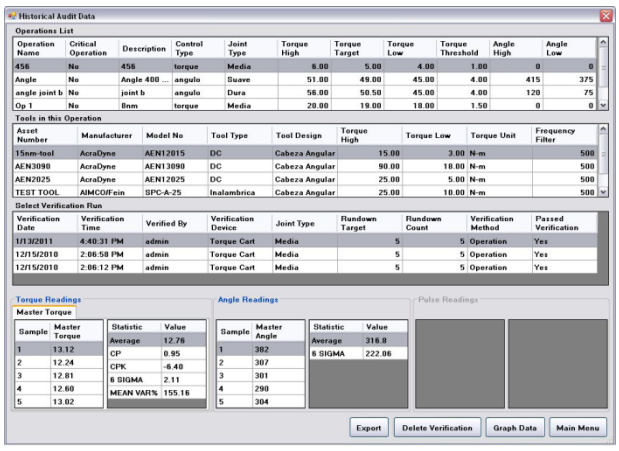
Operation Verification

The Operation Verification works just like the Tool Verification and Tool Verification Data tools work, except that it organizes tools by operation and allows tools to be qualified for the operation(s) in which they are assigned.

When you open the Operation Verification window or Operation Verification Data window, the selection screen is split in two. The top selection allows you to select the desired operation, while the bottom section allows you to select a tool associated with that operation.

The specifications used for an Operation Verification for Torque High/Low and Torque Target are obtained from the operation's specification for them. Make sure these values are correct as they are also used in statistical analysis.

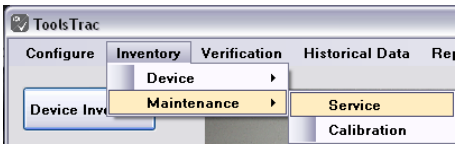


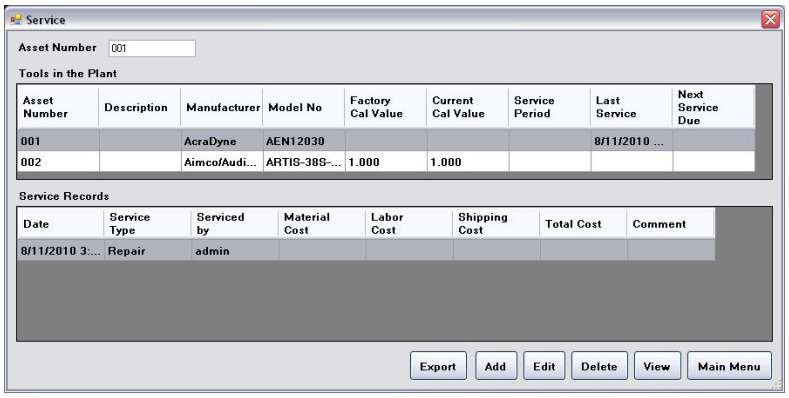


Maintenance:
Service

Service

1. Click on **Inventory** from the top pull-down menu.
2. Click on **Maintenance** in the pull-down menu.
3. Click on **Service** in the **Maintenance** pull-down menu.





Note: Assets requiring service immediately or are overdue are highlighted in red. Assets requiring service soon are highlighted in a light blue. All other assets are not highlighted.

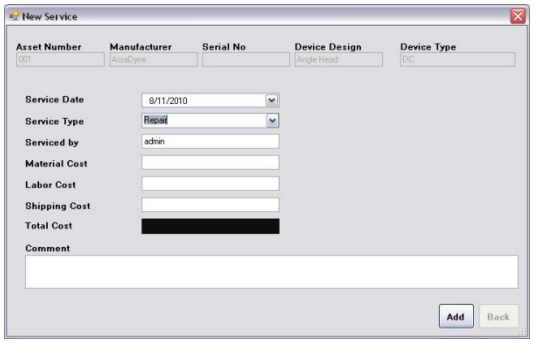
Note: The Export button allows to export the data to a comma separated (CSV), a tab separated (TSV), or an XML spreadsheet which can be opened in Microsoft Excel.

Viewing Service Records:

a) Click on the specified tool from the *Tools in the Plant* list.

b) Service Record Data will be displayed in the bottom list labeled *Service Records*.

Adding Service Records:



a) Click on the specified tool from the *Tools in the Plant* list.

b) Click the **Add** button at the bottom.

c) Select the Service Date and Service Type. All other fields are optional, but recommended that you enter as much information as possible.

d) Click the **Add** button to store the service record.

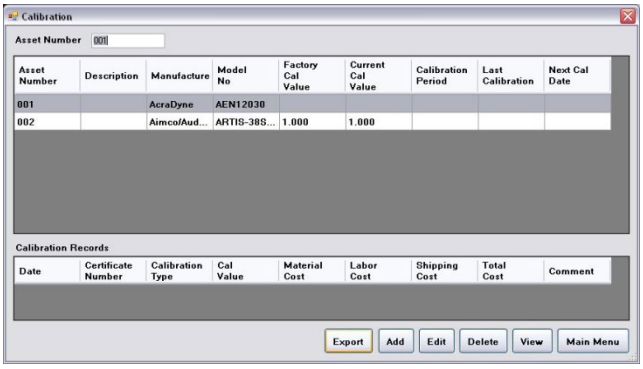
e) If you wish to make changes you may do so, and click the **Update** button to make the specified changes. Click the **Back** button to finish.

Editing Service Records:

a) Click on the specified tool from the *Tools in the Plant* list.
b) Click the **Edit** button at the bottom.
c) Make the specified changes.
d) Click the **Update** button to make the specified changes.
e) Click the **Back** button to finish.

Calibration

Calibration



1. Click on **Inventory** from the top pull-down menu.
2. Click on **Maintenance** in the pull-down menu.
3. Click on **Calibration** in the **Maintenance** pull-down menu.

Note: Assets requiring calibration immediately or are overdue are highlighted in red. Assets requiring calibration soon are highlighted in a light blue. All other assets are not highlighted.

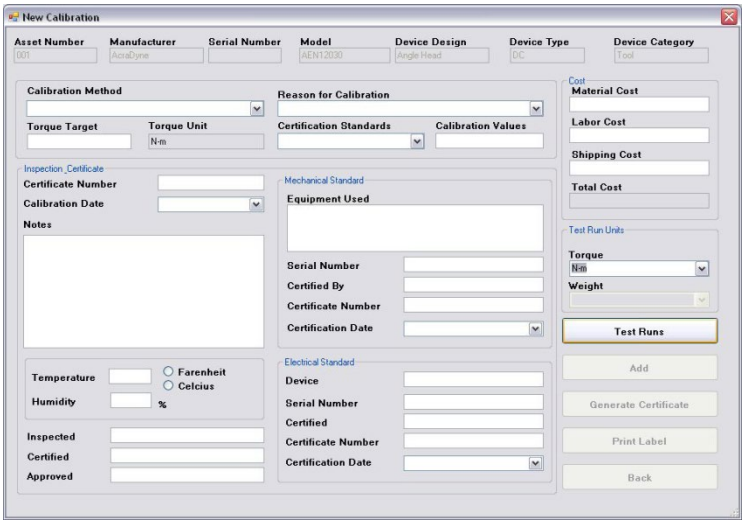
Note: The Export button allows to export the data to a comma separated (CSV), a tab separated (TSV), or an XML spreadsheet which can be opened in Microsoft Excel.

Viewing Calibration Records:

a) Click on the specified tool from the top list.

b) Calibration Record Data will be displayed in the bottom list labeled *Calibration Records*.

Adding Calibration Records:



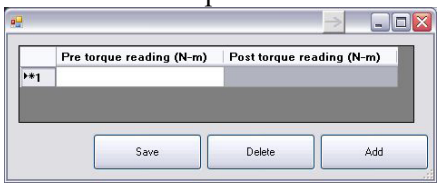
a) Click on the specified tool from the top list.

b) Click the **Add** button at the bottom.

c) Select the *Test Run Units*.

d) Click the **Test Runs** button.

e) In the window that pops-up, enter your pre and post test run torque readings. Click the **Save** button when you are done entering the test run information.



f) Select the **Reason for Calibration** and **Calibration Date**. All other information is optional, however it is recommended to enter as much information as possible.

g) Click the **Add** button.

h) It is now possible to generate a Certificate of Calibration for the tool by selecting the **Generate Certificate** button.

Editing Calibration Records:

a) Click on the specified tool from the top list.

b) Click the **Edit** button at the bottom.

c) Make the specified changes.

d) Click the **Update** button to save changes. Click the **Back** button to finish.

Generating a Calibration Certificate:

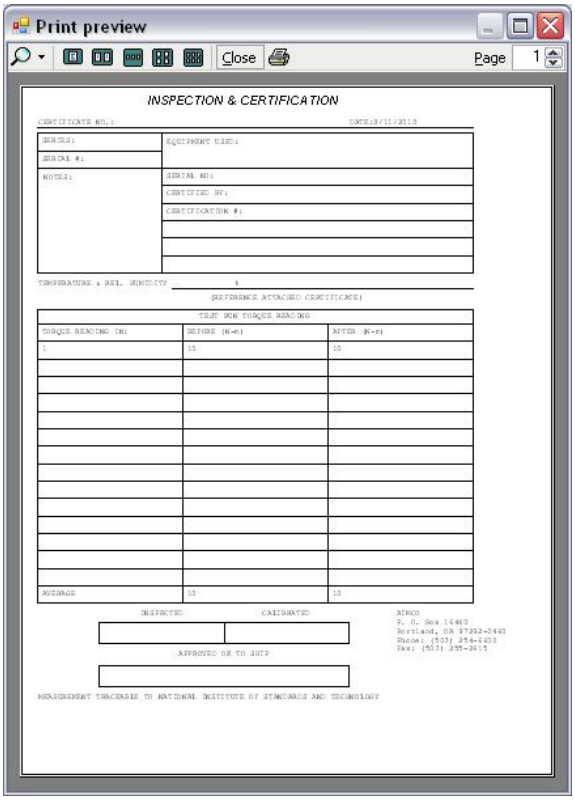
a) Click on the specified tool from the *Tools in the Plant* list.

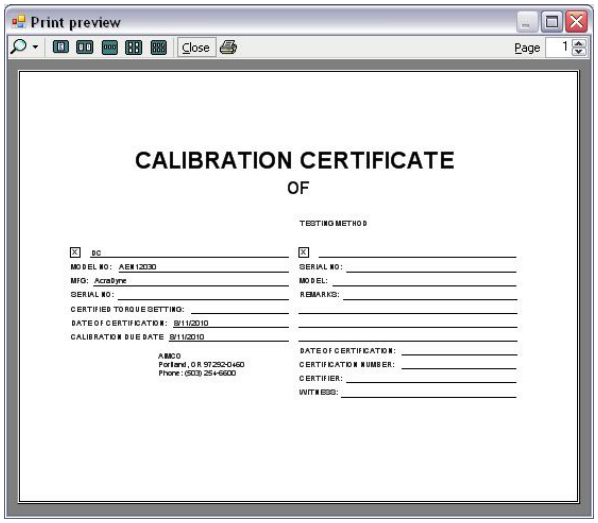
b) Click the **Edit** button at the bottom.

c) Click the **Generate Certificate** button.

d) The first window that shows up is the Inspection and Certification Certificate cover sheet. You may print it by selecting the printer icon at the top. Click the **Close** button to close this window

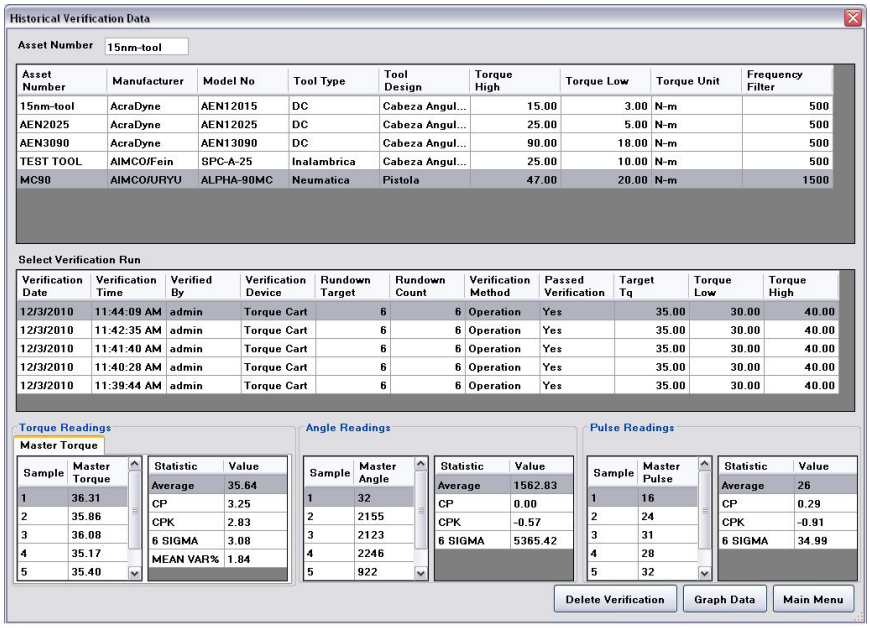
e) The next window that shows up is the actual certificate. You may also print this by selecting the printer icon at the top. Click the **Close** button to close this window.





Tool Verification Data

1. Click on **Historical Data** from the top pull-down menu.
2. Click on **Tool Verification Data** in the pull-down menu.
3. Select the desired tool from the top list.
4. Select the desired Verification run from the middle list labeled *Select Verification Run*.
5. Torque, Angle and Pulse readings will be displayed in the appropriate lists at the bottom.



Operation Verification Data

1. Click on **Historical Data** from the top pull-down menu.
2. Click on **Operation Verification Data** in the pull-down menu.
3. Select the desired operation from the top list
4. Select the desired tool from the next list down labeled *Tools in this Operation*.
5. Select the desired Verification run from the next list labeled *Select Verification Run*.
6. Torque, Angle and Pulse readings will be displayed in the appropriate lists at the bottom.
7. The "Graph Data" button at the bottom will open a window that graphs data for the Tool under the selected operation.

<u>Note:</u> If the selected verification run has readings from an External Transducer, a new Tab will appear next to the Master Torque Tab. Clicking on this tab will display the Torque Readings and Statistics to the External Transducer values.

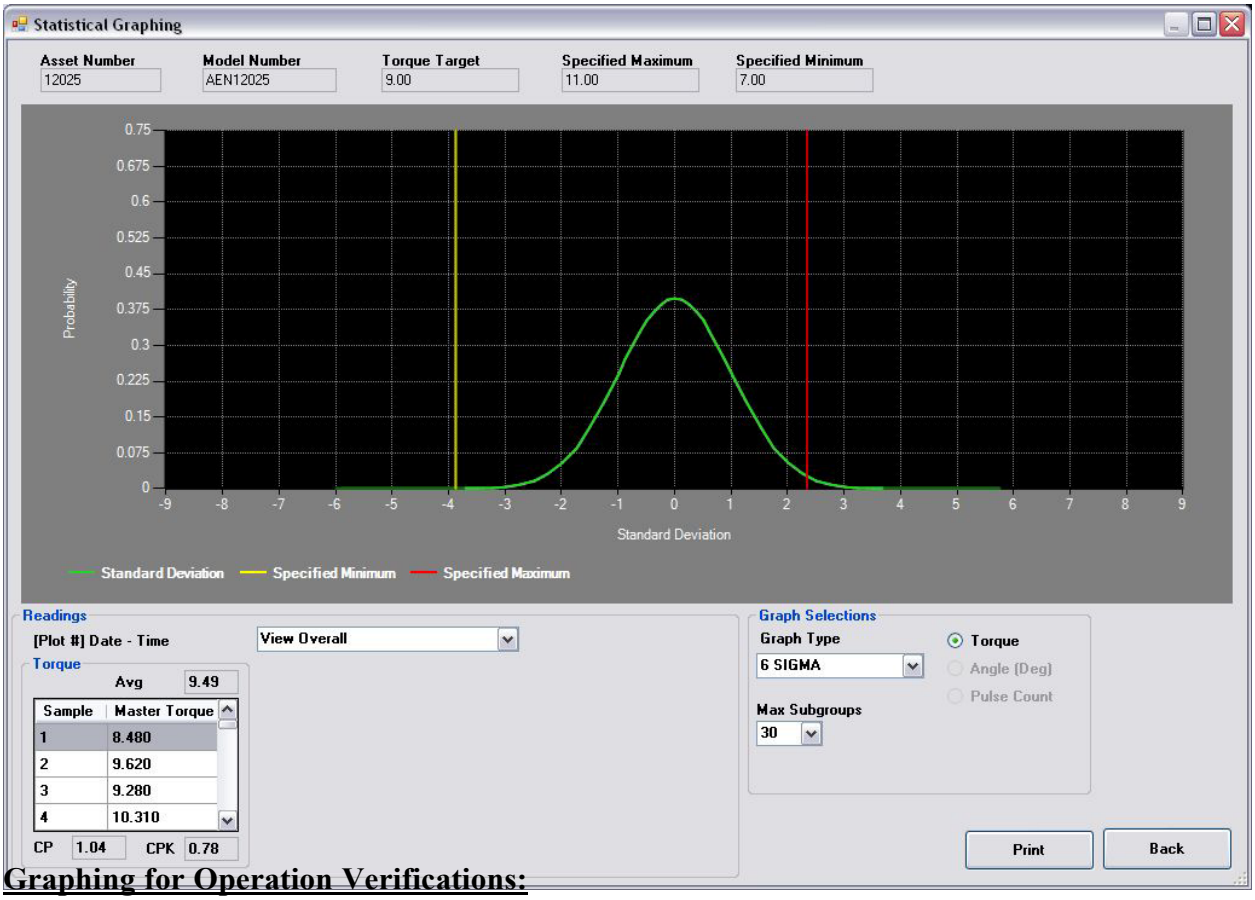
Statistical Graphing:

ToolsTrac provides statistical graphing tools that integrate with the Tool and Operation Verification processes. This allows for determining tool qualification and qualification tracking. The graphing tools included in ToolsTrac show Cp, CpK, Average, 6-Sigma, Histogram and X-bar Range graphs. The graphs can display these statistics for Torque only if used for Tool Verification, and also can be displayed for Angle and Pulse Count when used in conjunction with Operation Verifications.

Graphing for Tool Verifications:

When graphing Tool Verifications, there are a few options available:

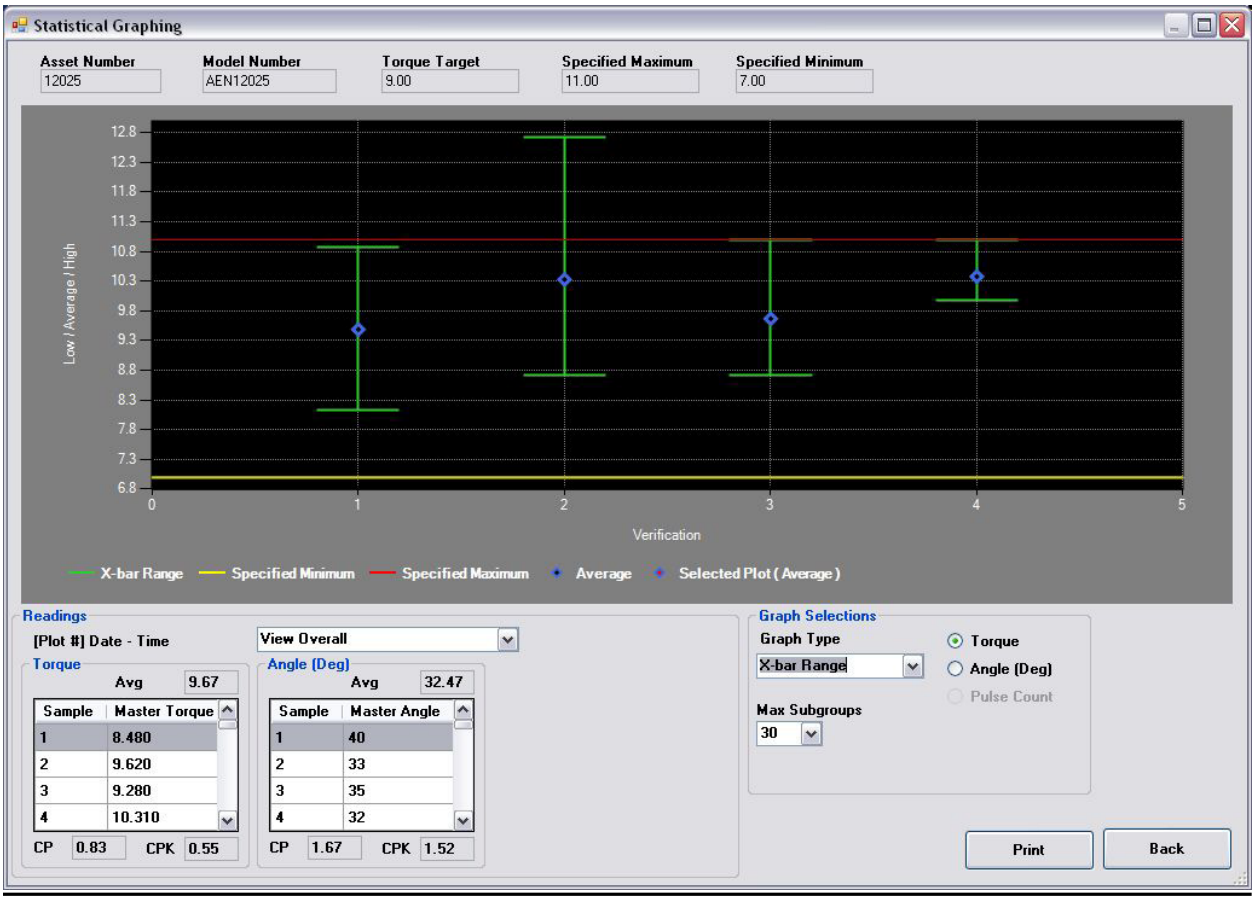
- Each Graph Type is available for this type of Verification
- Maximum Subgroups allows to display the most recent verifications statistically. There are options ranging from 5 to 100, the default is set to 30.
- Plot Selection allows for highlighting of individual verification runs on all graphs with exception of 6 Sigma and Histogram graphs.
- In the bottom Left there is a quick display of Sample Average/Cp/CpK for selected plot by date/time as well as individual torque readings. All torque readings from all Samples (limited by Max Subgroups) will be displayed if **View Overall** is selected.
- The **Print** button will allow you to print the graph and immediately available information displayed on the screen.



Graphing for Operation Verifications:

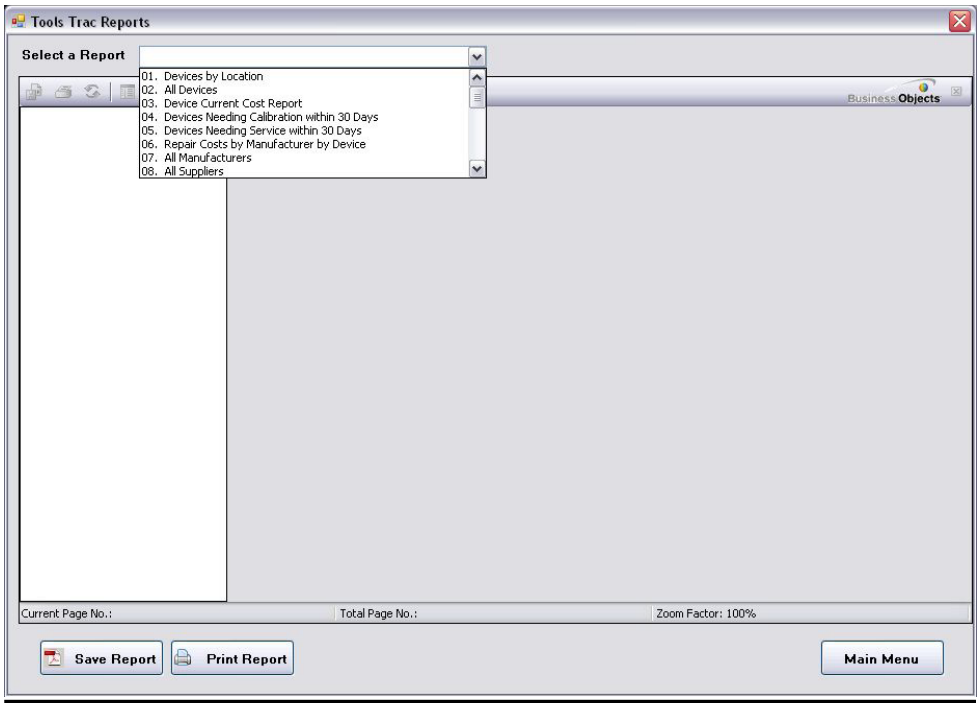
When graphing Operation Verifications the tools available differ from a regular Tool Verification Graph window:

- The Operation's Torque High/Low and Target is displayed at the top of the window.
- Individual subgroup readings are displayed, and selectable under the drop-down box labeled as "Readings View [Plot Number]".
    - Verifications are listed by plot number on the graph, and by its date/time performed.
    - Under the Cp, CpK, Average and X-Bar Range Graphs, the appropriate dot on the graph will be highlighted in **Red.**
    - An option in the list is "View Overall", this option loads all readings into the appropriate grids, limited only by the Subgroups included (as this is limited by the option "Max Subgroups"). This will display the Cp, CpK and Average values for all of these readings as well, in the appropriate text display boxes.
- Torque, Angle and Pulse are all available, depending on the Operation's specification. If the operation has a High Angle/Pulse Count set to 0, then the appropriate specification will be disabled.

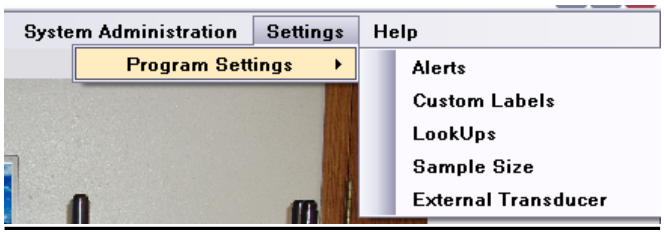


Reports

1. Click on **Reports** from the top pull-down menu.
2. Click on the **Select a Report** drop-down box to select the report you wish to generate.
3. The selected report will be displayed.
4. You may click **Save Report** to save this report to a PDF file or you may click the **Print Report** button to print the report out.

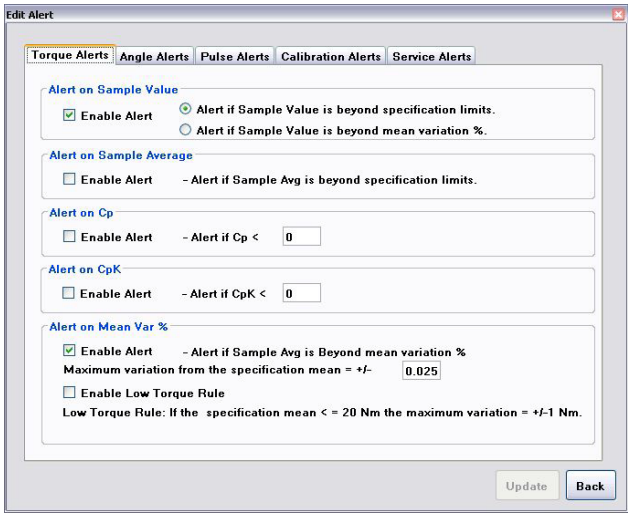


ToolsTrac Configuration Settings:



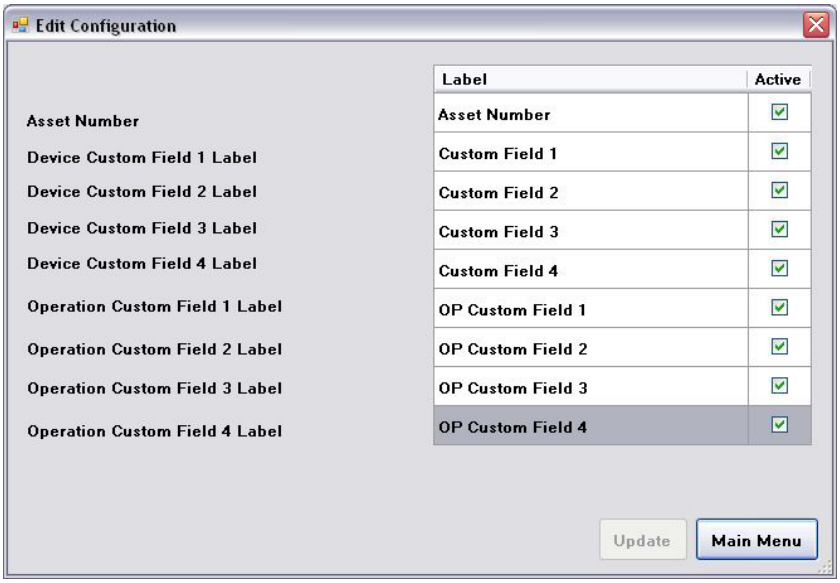
Alerts

1. Click on **Settings** from the top pull-down menu.
2. Click on **Program Settings** in the pull-down menu.
3. Click on **Alerts** in the **Program Settings** pull-down menu.



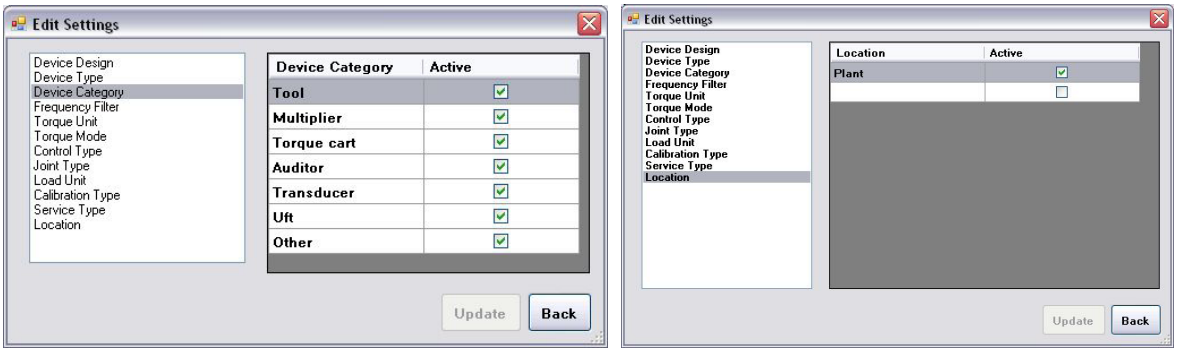
Custom Labels

1. Click on **Settings** from the top pull-down menu..
2. Click on **Program Settings** in the pull-down menu.
3. Click on **Custom Labels** in the **Program Settings** pull-down menu.
4. You may change the name of Asset Number, but cannot be de-selected as inactive.
5. There are 4 device custom fields and 4 operation custom fields, all of which allow custom naming and may be enabled or disabled at will.



Lookups

6. Click on **Settings** from the top pull-down menu.
7. Click on **Program Settings** in the pull-down menu.
8. Click on **LookUps** in the **Program Settings** pull-down menu.
9. One of the important usages for the LookUps menu is for Tool Location Tracking. Selecting the Location Lookup allows to add locations. Click on the empty location box to enter the name of the location. The Checkbox can be used to enable/disable that location. Now when adding/editing tools, the appropriate (enabled) locations will appear in the drop-down lists labeled as “Location”.
10. This tool also allows categories to be added dynamically in-case new technology or other categories are needed but not included by default in ToolsTrac.



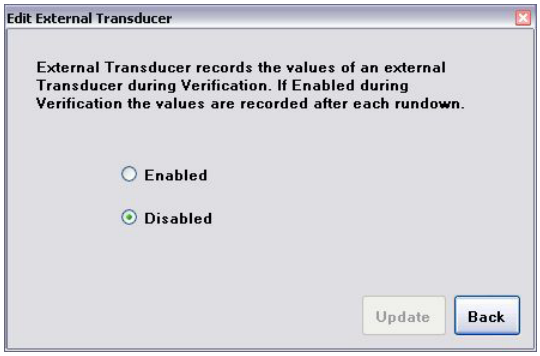
Sample Size

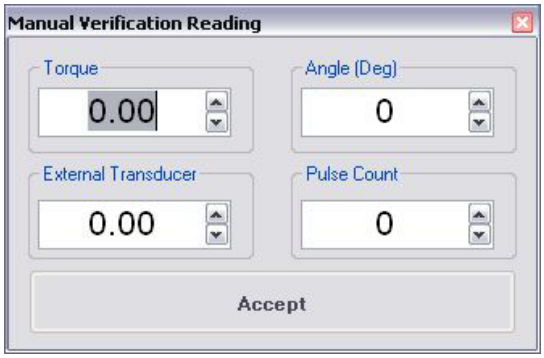
1. Click on **Settings** from the top pull-down menu.
2. Click on **Program Settings** in the pull-down menu.
3. Click on **Sample Size** in the **Program Settings** pull-down menu.

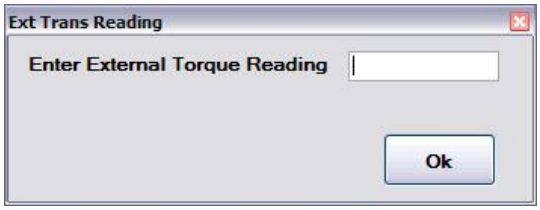
Using an External Transducer

1. Click on **Settings** from the top pull-down menu.
2. Click on **Program Settings** in the pull-down menu.
3. Click on **External Transducer** in the **Program Settings** pull-down menu.

   Note: When External Transducer is enabled, the pulse readings view in the torque verification screen will be replaced with the external torque readings data. Pulse info does not get recorded or saved for external transducer verifications. Whenever a rundown is completed, a window will popup asking for the external transducers' reading, except with manual verification, in which case the pulse reading input is replaced with external transducer reading input. Both shown below.







Torque Cart: Maintenance

Maintenance activities must be performed with the machine power turned off and locked out. Failure to do so may cause injury or damage to the cart.

Proper maintenance of your machine is essential to insure repeatability of torque readings and prevent excessive downtime

Electrical System

Repairs should be made to the electrical system by or under the direct supervision of a qualified electrician.
Keep all electrical wires and connections free from oil, grease, and water.

Lubrication

Oil or grease all moving parts at regular intervals to ensure smooth, even motion and minimum wear.
Avoid dropping oil and grease on electrical units or connections

Preventative Maintenance

Make sure all casters and swivel mechanisms are well lubricated with general-purpose grease.

Torque Cart: Troubleshooting

Problem: If transducers won't communicate with ToolsTrac.

Solution: Make sure the power switch is in the on position and the cart has a charge. If not, plug in the AC power cord for charging (8 hours for full charge).

Note: If you still have a problem: For the Laptop option: Check the computer and see if the Laptop is charging, by looking at the bottom right hand corner of the screen. If you see a plug, the computer is charging. Check the RJ45 connector connected from the PC's parallel port to the cart. If everything checks out and it still does not communicate, contact AIMCO for service.

Problem: If computer screen shows it is running on battery power then check the power supply located inside the cart.

Solution: Check the 10 amp fuse located inside the cart next to the power switch.

Check cart main power (see utility cart section of maintenance procedures).

Problem: If ToolsTrac displays message: "HW_ERROR", "READ_ERROR" or "WRITE_ERROR"

Solution: Check the connection between the computer and the USB CAN-dongle. Make sure the Torque Cart has power. If problem persists it may be necessary to try another USB CAN-dongle or to contact customer service for additional troubleshooting.

Note: If this message pops up during a verification run, try resetting the acquisition, or backing out of the verification screen and starting a new verification.

Problem: When opening ToolsTrac, it displays message: "Error connecting to database…"

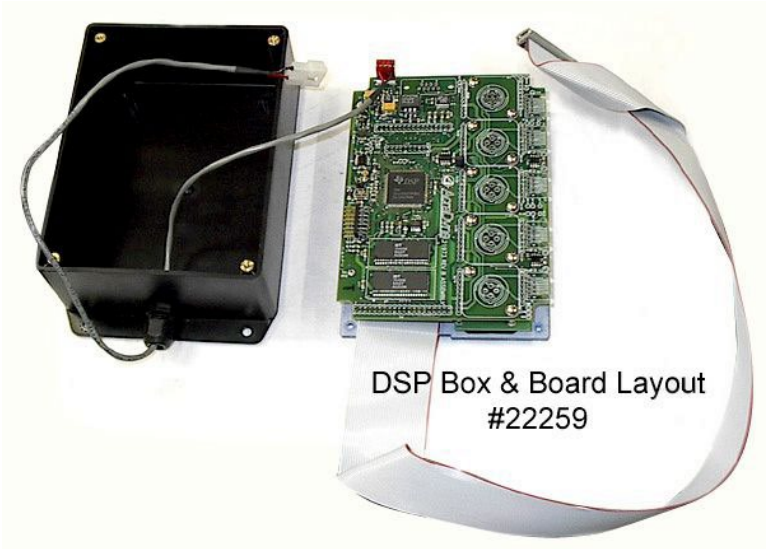
Solution: Either the ToolsTrac configuration is pointing to the wrong database, or the database is not running or installed properly. Check ToolsTrac Installation section to make sure database server and ToolsTrac configuration files are configured properly.

Torque Cart: Parts List

Qty.	Part #	Description
1	21888	Transducer, Industry Std. 20 NM 1/4” hex dr.
1	21887	Transducer, Industry Std. 75 NM 3/8” sq dr.
1	21886	Transducer, Industry Std. 180 NM 1/2” sq dr.
1	21885	Transducer, Industry Std. 500 NM 3/4” sq dr.
1	22332	Transducer cable, external
1	22361	Transducer cable, internal
1	22259	16 Bit DSP module
1	22167	LED Interconnect board
1	23289	Utility cart

Torque Cart: Photos

Utility Cart



Torque Cart: Glossary

Angle:	The measure of degree of rotation of a fastener from threshold torque to final torque. This typically does not include the free rundown before the head of the fastener hits the surface of the work piece.
Angle Lo/High:	Angle is typically measured during rundown of continuous drive tools to detect cross threading (for low angles) and stripping or yielded fasteners (for high angles).
Calibration:	Setting a device to a known standard.
CAN:	Controller Area Network
Cp:	An indication of process repeatability. A Cp above 1 illustrates that the process or tool is capable.
Cpk:	An indication of process repeatability with respect to specification limits. 1.33 and 1.66 are common target values for Cpk
Dongle:	A device that plugs into the computer and the RJ-45 cable.
Filter Hz:	The units of frequency response used within a torque analyzer to filter the dynamic torque signal. A setting if 500 Hz is suitable for hand and continuous drive power tools. A setting of 1500 Hz is suitable for discontinuous drive pulse tools.
Pulse Count Lo/High:	Pulse count can be measured when using a pulse tool for the same reasons as measuring angle on continuous drive tools.
RJ-45:	A type of network cable typically used for CAN or Ethernet networks. It looks similar to a telephone cable with a larger connector.
Standard Deviation:	A way of measuring how close a certain percentage of the reading is to the average. The standard deviation is a “distance” from the average. Readings within 3 standard deviation distances above and below the average will account for 99.73% of all readings (at 1.33 Cpk). This is also commonly known as 6 sigma, representing the addition of the 3 standard deviations (also known as sigma) on both sides of the average.
Torque Threshold:	The torque reading at which the transducer starts measuring angle or pulse count.
Transducer:	A device that converts force into signal. This is typically done by measuring voltage or current changes as force is applied.

UFT Joint Simulator: Operations Instructions

UFT-S10 and UFT-S16

These testers are capable of simulating four different joints: A, B, C, and D (hard, medium-hard, medium-soft, and soft, respectively).

A Joint: C and D valves closed (clockwise) and the A joint sleeve installed between the Plunger Bushing and the Spindle Nut.

B Joint: C and D valves closed (clockwise) and remove the A joint sleeve.

C Joint: Open the D valve under the side cylinder one turn (counter-clockwise). The C valve remains closed.

D Joint: Open both the C and D valves (one turn).

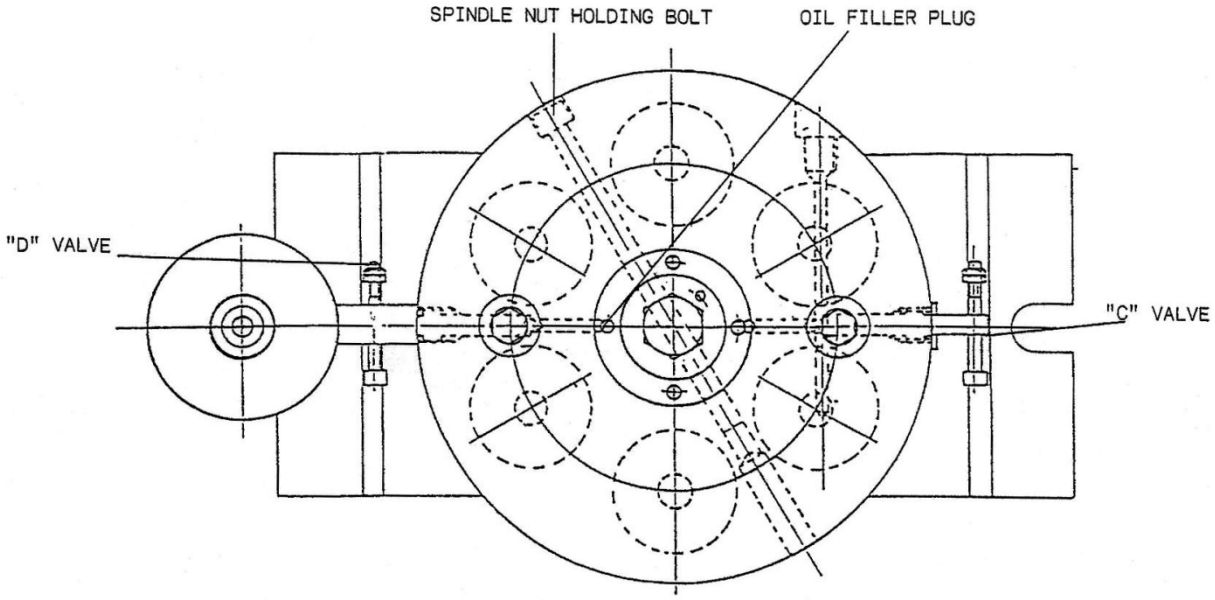
CHANGING BOLT KITS

To change the bolt:

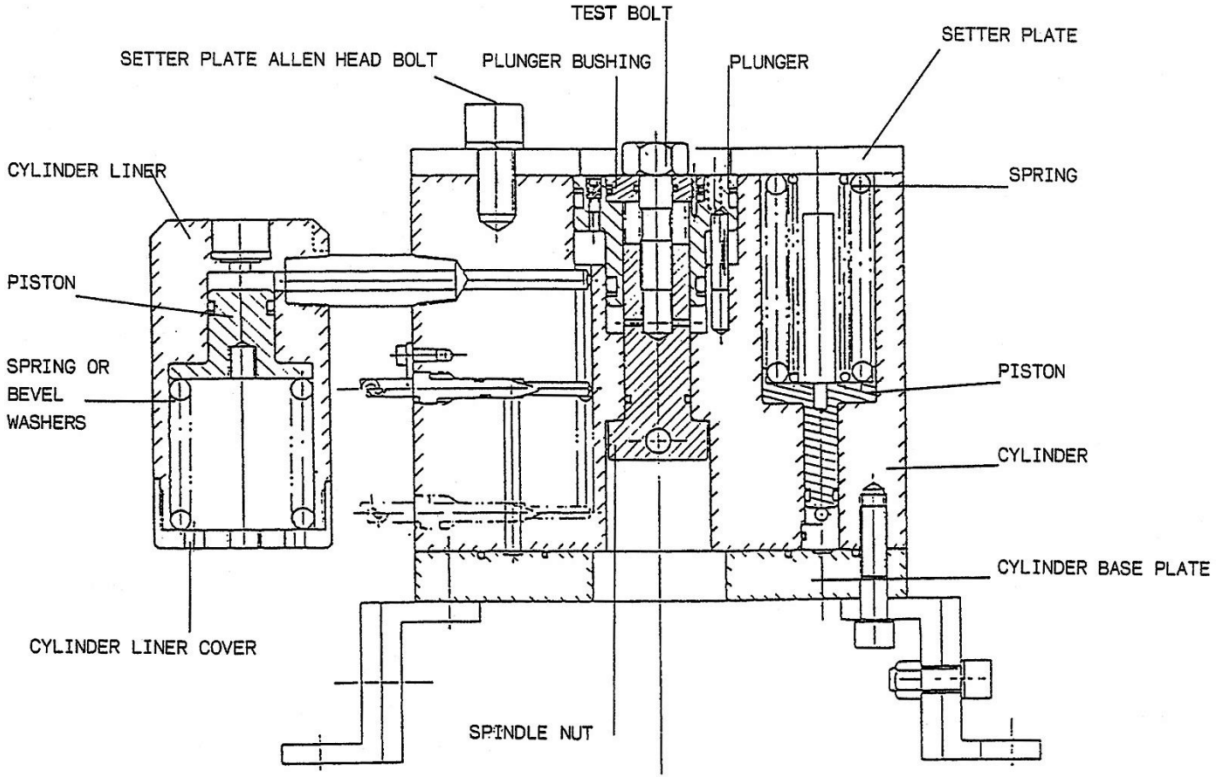
1. Remove the test bolt.
2. Remove the Spacer and Plunger Bushing.
3. Remove the Allen Head Bolt that holds the Spindle Nut. This is located on the side of the tester by the D valve lever.
4. Remove the Spindle Nut.
5. Install the new Spindle Nut.
6. Install the Allen Head Bolt back through the Spindle Nut.
7. Install the Plunger Bushing, Spacer, and new bolt.

UFT Joint Simulator: Breakdown of the UFT-S Joint Simulator

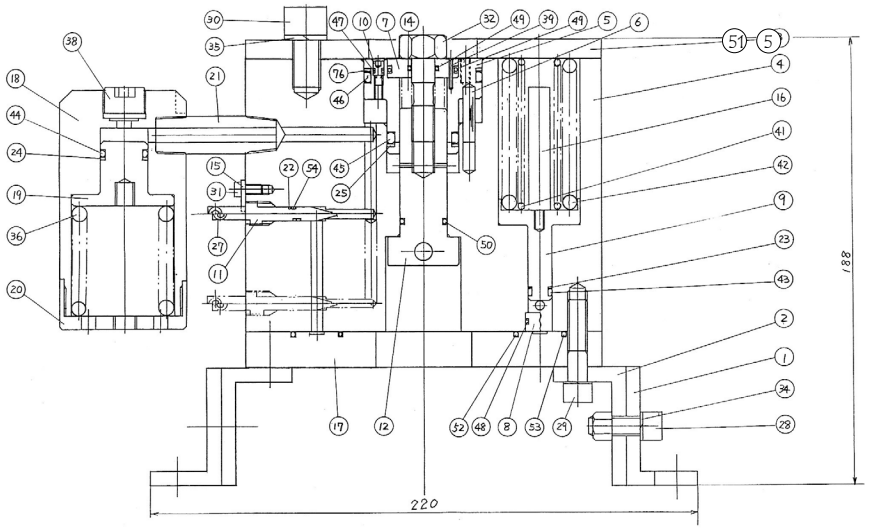
Top View of UFT-S Joint Simulator



Side View of UFT-S Joint Simulator



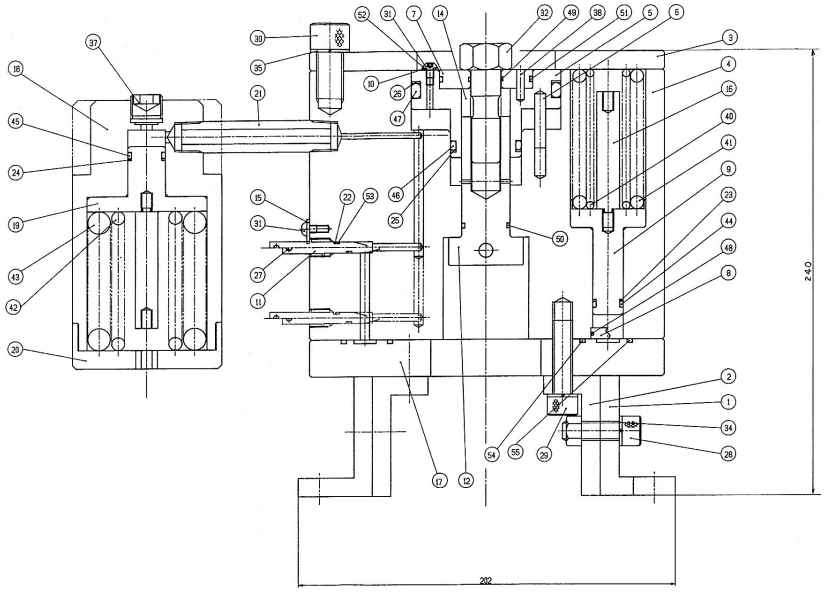
UFT Joint Simulator: Breakdown of the UFT-S10 Joint Simulator



Index No.	Code No.	Description	Qty.
1	839-965-5	Setting Stand	2
2	839-718-5	Setting Plate	2
3	839-285-5	Rear Plate	1
4	839-286-5	Cylinder	1
5	839-600-5	Plunger	1
6	840-318-5	Pilot Pin	4
7	839-604-5	Plunger Bushing	1
8	839-674-5	Cylinder Bushing	1
9	839-546-5	Piston	6
10	194-742-3	Oil Plug	1
11	839-100-5	Valve	2
12	839-359-5	Spindle Nut	1
13	839-562-5	Checker	1
14	839-567-5	Bushing (M10)	1
15	839-019-5	Valve Cover	2
16	839-560-5	Spring Guide	6
17	839-289-5	Front Plate	1
18	839-017-5	Oil Casing	1
19	839-545-5	Piston (large)	1
20	839-016-5	Oil Casing Cover	1
21	839-082-5	Connecting Screw	1
22	944-005-0	Back-up Ring (4.2 x 6 x 1)	2
23	944-015-0	Back-up Ring (P7)	6
24	944-316-0	Back-up Ring (P16)	1
25	944-025-0	Back-up Ring (P24)	1
26	944-044-0	Back-up Ring (P44)	1
27	945-005-0	Allen Head Bolt (M3 x 50)	2
28	945-325-0	Allen Head Bolt (M8 x 25)	4
29	945-330-0	Allen Head Bolt (M8 x 30)	10
30	945-443-0	Allen Head Bolt (M12 x 20)	2
31	945-942-0	Hexagon Round Head Bolt (M4 x 6)	2
32	946-972-0	Hexagonal Bolt (M10 x 35) (UFT)	1
33	960-020-0	Hexagon Nut (1-M3)	4
34	962-011-0	Spring Washer (2-8S)	14
35	962-013-0	Spring Washer (2-12S)	2
36	962-644-0	Belleville Spring (42 x 14.3 x 2.5)	17
37	966-100-0	Allen Head Plug (1/8)	1

Index No.	Code No.	Description	Qty.
38	966-102-0	Allen Head Plug (3/8)	1
39	973-114-0	Roll Pin (3 x 14)	1
40	975-552-0	Spacer (22 x 10.5 x 3) (H)	1
41	976-495-0	Spring (21 x 65)	6
42	976-706-0	Spring (33 x 65)	6
43	990-004-0	O-Ring (P6)	6
44	990-015-0	O-Ring (P15)	1
45	990-024-0	O-Ring (P24)	1
46	990-041-0	O-Ring (P44)	1
47	990-971-0	O-Ring (SNS-3) (NOK)	2
48	990-906-0	O-Ring (SNS-8)	2
49	990-908-0	O-Ring (SNS-10)	1
50	990-914-0	O-Ring (SNS-16)	1
51	990-919-0	O-Ring (SNS-22)	1
52	990-993-0	O-Ring (SNS-70)	1
53	990-998-0	O-Ring (SNS-112)	1
54	990-972-0	O-Ring (SNS-4) (NOK)	2
Option			
M8 Type			
14	878-903-1	Bushing (M8)	1
56	878-901-1	Plunger Bushing (M8)	1
57	878-902-1	Spindle Nut (M8)	1
58	946-971-0	Hexagonal Bolt (M8 x 32) (UFT)	1
59	975-551-0	Spacer (18 x 8.5 x 2.5) (H)	1
60	990-906-0	O-Ring (SNS-8)	1
61	990-919-0	O-Ring (SNS-22)	1
M6 Type			
14	878-908-1	Bushing (M6)	1
62	878-906-0	Plunger Bushing (M6)	1
63	878-907-0	Spindle Nut (M6)	1
64	946-970-0	Hexagonal Bolt (M6 x 30) (UFT)	1
65	975-550-0	Spacer (14 x 6.5 x 2) (H)	1
66	990-904-0	O-Ring (SNS-6)	1
67	990-919-0	O-Ring (SNS-22)	1

UFT Joint Simulator: Breakdown of the UFT-S16 Joint Simulator



Index No.	Code No.	Description	Qty.
1	839-965-6	Setting Stand	2
2	839-718-6	Setting Plate	2
3	839-285-6	Rear Plate	1
4	839-286-6	Cylinder	1
5	839-600-6	Plunger	1
6	840-318-6	Pilot Pin	4
7	840-604-6	Plunger Bushing	1
8	839-674-6	Cylinder Bushing	3
9	839-546-6	Piston	9
10	185-807-1	Spacer	2
11	839-100-5	Valve	2
12	839-359-6	Spindle Nut	1
13	839-562-6	Checker	1
14	839-567-6	Bushing (M16)	1
15	839-019-5	Valve Cover	2
16	839-560-6	Spring Guide	6
17	839-289-6	Front Plate	1
18	839-017-6	Oil Casing	1
19	839-545-6	Piston (large)	1
20	839-016-6	Oil Casing Cover	1
21	839-082-6	Connecting Screw	1
22	944-005-0	Back-up Ring (4.2 x 6 x 1)	2
23	944-312-0	Back-up Ring (P12)	9
24	944-316-0	Back-up Ring (P16)	1
25	944-032-0	Back-up Ring (P32)	1
26	944-070-0	Back-up Ring (P70)	1
27	945-005-0	Allen Head Bolt (M3 x 50)	2
28	945-429-0	Allen Head Bolt (M10 x 35)	10
29	945-433-0	Allen Head Bolt (M10 x 45)	4
30	945-505-0	Allen Head Bolt (M14 x 30)	3
31	945-942-0	Hexagon Round Head Bolt (M4 x 6)	2
32	946-975-0	Hexagonal Bolt (M16 x 50) (UFT)	1
33	960-020-0	Hexagon Nut (1-M3)	4
34	962-012-0	Spring Washer (2-10S)	14
35	962-014-0	Spring Washer (2-14S)	3
36	966-100-0	Allen Head Plug (1/8)	2

Index No.	Code No.	Description	Qty.
37	966-102-0	Allen Head Plug (3/8)	1
38	973-216-0	Roll Pin (4 x 16)	1
39	975-557-0	Spacer (35 x 16.5 x 3) (H)	1
40	976-561-0	Spring (23 x 75)	9
41	976-711-0	Spring (37.5 x 75)	10
43	976-780-0	Spring (64 x 75)	9
44	990-010-0	O-Ring (P11)	9
45	990-015-0	O-Ring (P15)	1
46	990-032-0	O-Ring (P32)	1
47	990-055-0	O-Ring (P70)	1
48	990-912-0	O-Ring (SNS-14)	3
49	990-916-0	O-Ring (SNS-16)	1
50	990-918-0	O-Ring (SNS-20)	1
51	990-937-0	O-Ring (SNS-46)	1
52	990-971-0	O-Ring (SNS-3) (NOK)	2
53	990-972-0	O-Ring (SNS-4) (NOK)	2
54	990-996-0	O-Ring (SNS-100)	1
55	990-999-0	O-Ring (SNS-150)	1
Option			
M14 Type			
14	878-912-1	Bushing (M14)	1
57	878-777-1	Plunger Bushing (M14)	1
58	878-911-1	Spindle Nut (M14)	1
59	946-974-0	Hexagonal Bolt (M14 x 50) (UFT)	1
60	975-556-0	Spacer (30 x 14.5 x 3) (H)	1
61	990-912-0	O-Ring (SNS-14)	1
62	990-937-0	O-Ring (SNS-46)	
M12 Type			1
14	878-917-1	Bushing (M12)	1
64	878-781-1	Plunger Bushing (M12)	1
65	878-916-1	Spindle Nut (M12)	1
66	946-973-0	Hexagonal Bolt (M12 x 45) (UFT)	1
61	975-555-0	Spacer (26 x 12.5 x 3) (H)	1
62	990-911-0	O-Ring (SNS-12)	
63	990-937-0	O-Ring (SNS-46)	

UFT Joint Simulator: Operations Instructions

UFT-6, UFT-10, UFT-16 and UFT-24

Warning

1. Always operate test bolt within specified torque range.
2. Always secure joint simulator before use.

Operation Cautions

1. Never change joints without loosening the test bolt.
2. Check the test bolt every 50,000 cycles.
3. Double-check all bolts after changing joints and bolt sizes.
4. Never use sloppy sockets or extensions.
5. Always use Power Driver Sockets per ANSI B107.2.

Operation Instructions

UFT-6, UFT-10, UFT-16 and UFT-24

There are two joints on these models: A "B" joint (medium-hard) and a "C" joint (medium-soft). To change these joints, simply turn the silver knob on the front of the tester clockwise until it stops for the "B" joint and counter- clockwise until it stops for the "C" joint.

Changing Bolt Kits

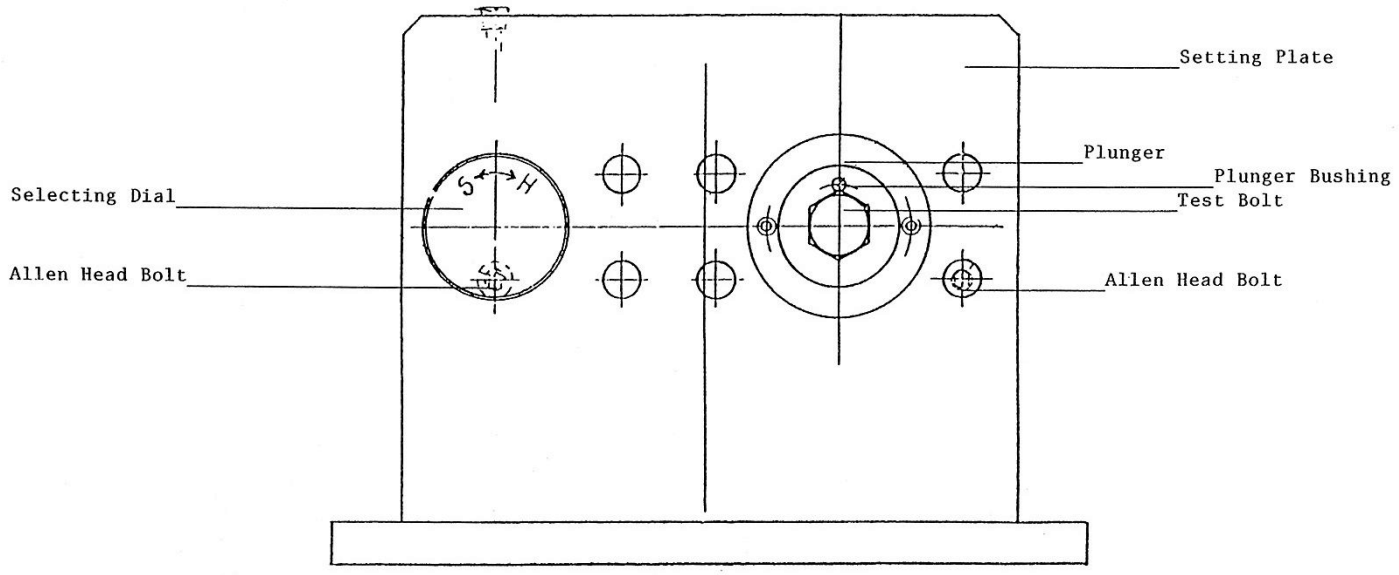
UFT-10, UFT-16 and UFT-24

1. Each bolt kit has certain springs that go with them. Please consult the chart below to match the right spring with the size of bolt that you are using.
2. To change bolts:
   a) Remove the test bolt and Plunger Bushing.
   b) On the UFT-10 and UFT-16, remove the two Allen Head Bolts from the Spindle Nut located on the back of the testers. Insert the new Spindle Nut and re-install the Allen Head Bolts.
   c) Install the new bolt and Plunger Bushing.
   d) Remove the Cylinder Liner Casing Cover and change out the springs. Reinstall the Cylinder Liner

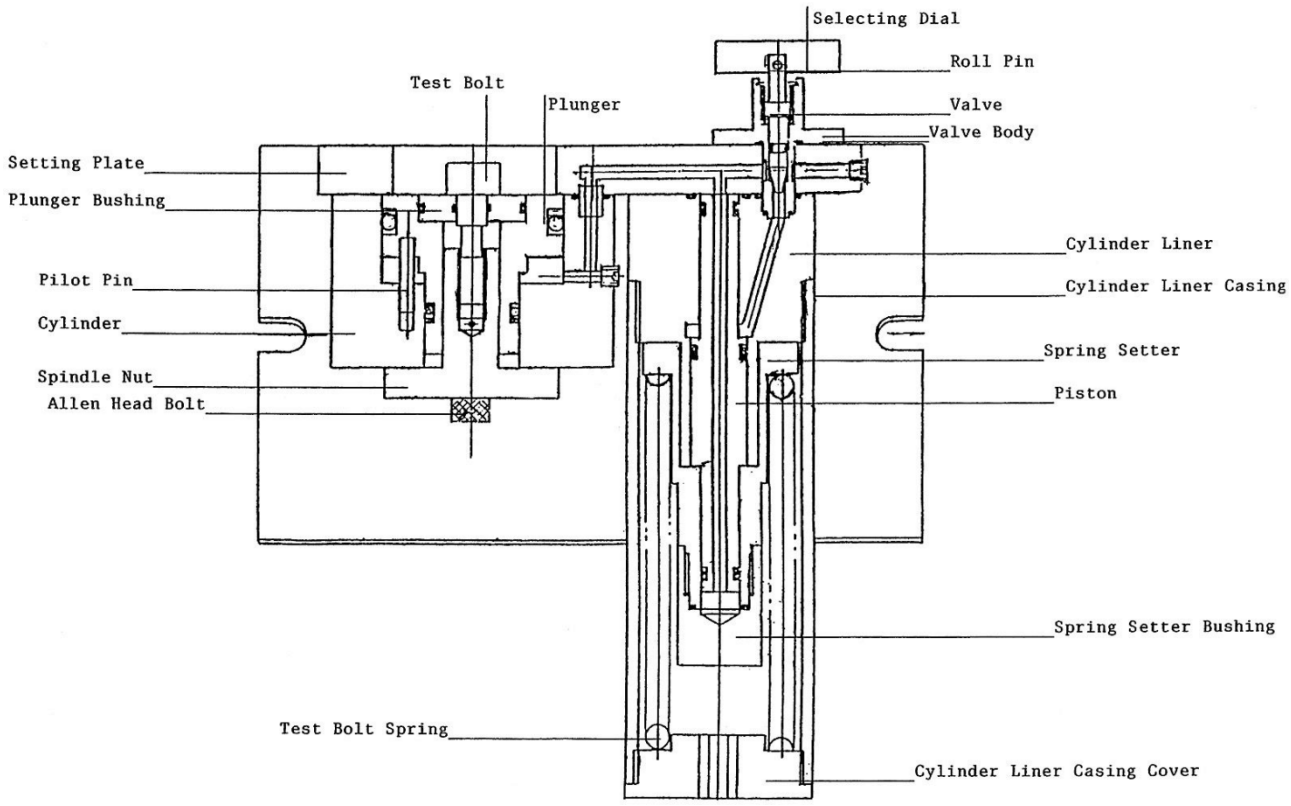
Model	Bolt Size	Spring Size Installed Into the Chamber and the Quantity Used		
UFT-10	M6	48.5 x 120	(8.5)	1 pc.
	M8	51 x 120	(9.5)	1 pc.
	M10	51 x 120	(10.0)	1 pc.
UFT-16	M12	49 x 120	(9.0)	2 pcs.
	M14	49 x 120	(9.0)	2 pcs.
	M16	49 x 120	(9.5)	2 pcs.
UFT-24	M18	59 x 115	(11.0)	3 pcs.
	M20	59 x 115	(11.0)	3 pcs.
	M20	35.5 x 105	(6.6)	3 pcs.
	M24	59 x 115	(11.0)	3 pcs.
	M24	35 x 105	(7.0)	3 pcs.

UFT Joint Simulator: Breakdown of the UFT-BC Joint Simulator

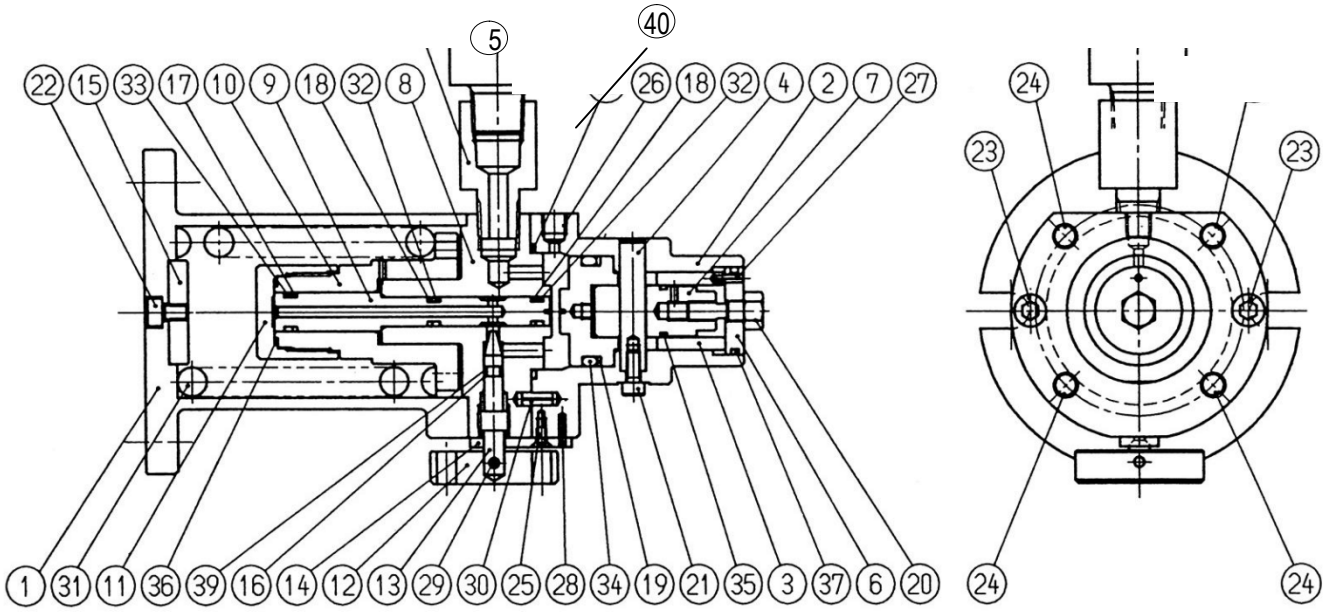
Front View



Top View



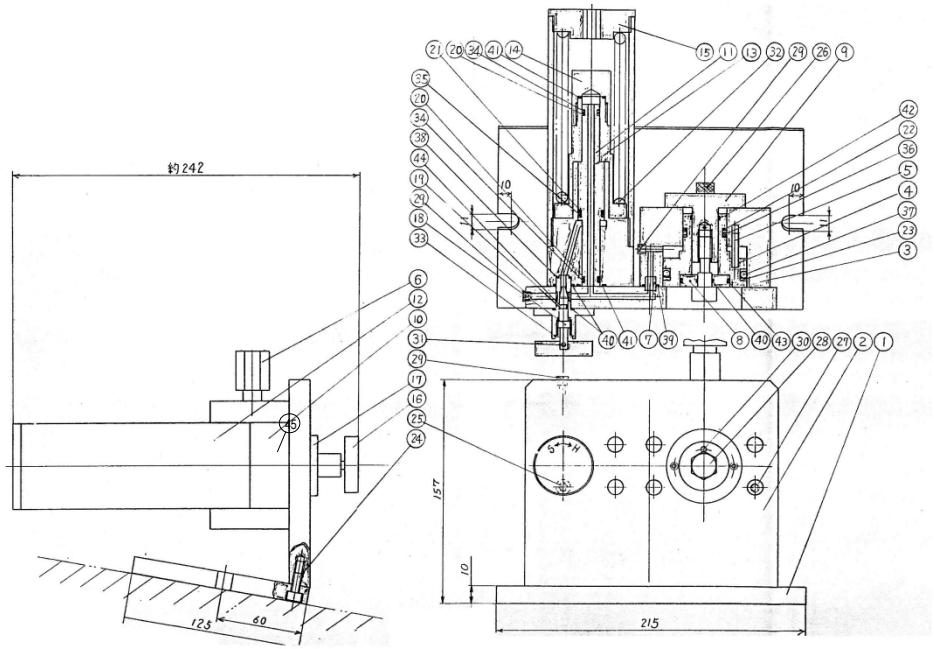
UFT Joint Simulator: Breakdown of the UFT-6 Joint Simulator



Index No.	Code No.	Description	Qty
1	840-965-	Setting Stand	
4		Cylinder	1
2	840-286-	Plunger	1
4		Pilot Pin	1
3	840-600-	Setting Screw for Pressure Sensor	1
4		Plunger Bushing (M6)	1
4	840-318-	Spindle Nut (M6)	1
4		Cylinder Liner	1
5	840-049-	Piston	1
5		Retainer	1
6	840-604-	Retainer Bushing	1
4		Valve Lever	1
7	840-359-	Valve	1
4		Valve Wheel Nut Flange	1
8	840-676-	Spring Holder Spacer	1
4		Support Ring (42 x 6 x 1)	1
9	840-546-	Back-up Ring (P9)	1
4		Back-up Ring (P6)	1
10	840-164-	Back-up Ring (P28)	1
4		Hexagon Bolt (M6 x 18) (UFT)	2
11	840-175-	Spacer (14 x 6.5 x 2) (H)	1
4		Allen Head Bolt (M4 x 10)	1
12	840-107-	Allen Head Bolt (M5 x 8)	1
5		Allen Head Bolt (M6 x 45)	1
13	840-100-	Allen Head Bolt (M8 x 25)	1
5		Allen Flush Head Screw (M3 x 6)	2
14	840-133-	Allen Head Plug (NPT1/16)	4
4		Roll Pin (2 x 8)	1
15	840-166-	Roll Pin (2 x 10)	1
4		Roll Pin (3 x 30)	1
16	944-005-	Roll Pin (4 x 10)	1
0			
17	944-011-		

Index No.	Code No.	Description Qty.	
31	976-768-		
0		Spring (52 x 80) (9.0)	1
32	990-004-	O-Ring (P6)	1
0		O-Ring (P9)	2
33	990-007-	O-Ring (P28)	1
0		O-Ring (SNS-14)	1
34	990-027-	O-Ring (SNS-18)	1
0		O-Ring (SNS-24)	1
35	990-912-	O-Ring (SNS-38)	1
0		O-Ring (SNS-4)	1
36	990-916-	Allen Head Plug (3/8)	1
0		Test Socket (10 x 3/8)	1
37	990-917-	Spacer (14 x 6.5 x 2) (H)	1
0			
38	990-928-		
0			
39	990-972-	Plunger Bushing (M5)	1
0		Spindle Nut (M5)	1
40	966-102-	Hexagon Bolt (M5 x 17) (UFT)	1
0		Spacer (12 x 5.5 x 2) (H)	1
41	878-850-	O-Ring (SNS-14)	1
1		O-Ring (SNS-24)	1
42	975-550-		
1			
		Plunger Bushing (M4)	1
M5 Type		Spindle Nut (M4)	1
45	878-763-	Hexagon Bolt (M4 x 15) (UFT)	1
1		Spacer (10 x 4.5 x 2) (H)	1
46	878-764-	O-Ring (SNS-14)	1
1			

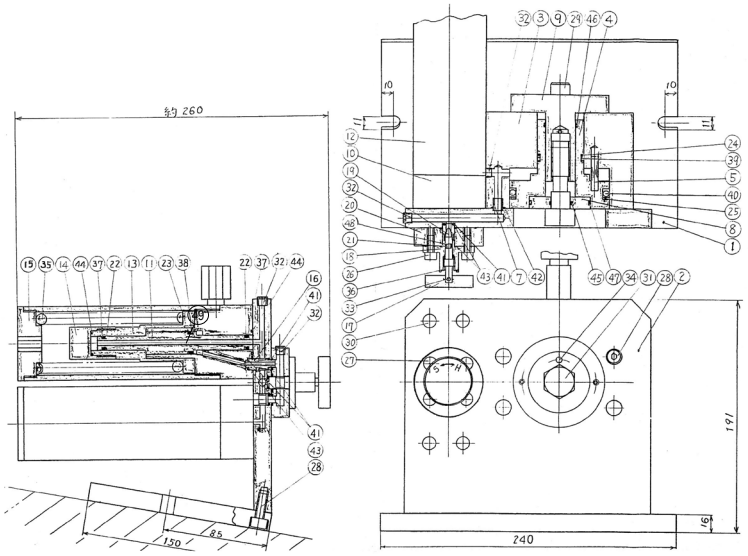
UFT Joint Simulator: Breakdown of the UFT-10 Joint Simulator



Index No.	Code No.	Description	Qty
1	840-965-5	Setting Stand	1
2	840-718-5	Setting Plate	1
3	840-286-5	Cylinder	1
4	840-600-5	Plunger	1
5	840-318-5	Pilot Pin	4
6	840-049-5	Pressure Gauge Stand Screw	1
7	840-674-5	Cylinder Bushing	1
8	840-604-5	Plunger Bushing (M10)	1
9	840-359-5	Spindle Nut (M10)	1
10	840-676-5	Cylinder Liner	1
11	840-546-5	Piston	1
12	840-905-5	Cylinder Liner Casing	1
13	840-164-5	Spring Setter	1
14	840-175-5	Spring Setter Bushing	1
15	840-906-5	Cylinder Liner Casing Cover	1
16	840-107-5	Selecting Dial	1
17	840-014-5	Valve Body	1
18	840-100-5	Valve	1
19	944-005-0	Backup Ring (4.2 x 6 x 1)	1
20	944-011-0	Backup Ring (P9)	1
21	944-017-0	Backup Ring (P14)	2
22	944-025-0	Backup Ring (P24)	1
23	944-045-0	Backup Ring (P48A)	1
24	945-214-0	Allen Head Bolt (M6 x 14)	1
25	945-230-0	Allen Head Bolt (M6 x 30)	3
26	945-320-0	Allen Head Bolt (M8 x 20)	2
27	945-967-0	Hexagon Round Head Bolt (M6 x 25)	2
28	946-972-0	Hexagonal Bolt (M10 x 35) (UFT)	6
28-1	975-552-0	Spacer (22 x 10.5 x 3) (H)	1
29	966-110-0	Allen Head Plug (NPT1/6)	3
30	973-114-0	Roll Pin (3 x 14)	1
31	973-130-0	Roll Pin (3 x 30)	1

Index No.	Code No.	Description	Qty
32	976-767-0	Spring (51 x 120) (10.0)	1
		Inner Snap Ring (IRTW-12)	1
33	979-312-0	O-Ring (P9)	2
		O-Ring (P14)	1
34	990-007-0	O-Ring (P24)	1
		O-Ring (P48A)	1
35	990-014-0	O-Ring (SNS-6)	1
		O-Ring (SNS-7)	1
36	990-024-0	O-Ring (SNS-10)	3
		O-Ring (SNS-15)	2
37	990-045-0	O-Ring (SNS-18)	1
		O-Ring (SNS-30)	1
38	990-904-0	O-Ring (SNS-4) (NOK)	1
		Allen Head Plug (3/8)	1
39	990-905-0		1
40	990-908-0	Plunger Bushing (M8)	
41	990-913-0	Spindle Nut (M8)	1
		Hexagonal Bolt (M8 x 32) (UFT)	1
42	990-916-0	Spacer (18 x 8.5 x 2.5) (H)	1
43	990-924-0	Spring (51 x 120) (9.5)	1
		O-Ring (SNS-8)	1
44	990-972-0	O-Ring (SNS-30)	1
45	966-102-0		
		Plunger Bushing (M6)	1
		Spindle Nut (M6)	1
M8 Type		Hexagonal Bolt (M6 x 30) (UFT)	1
47	878-770-1		1
		Spacer (14 x 6.5 x 2) (H)	1
48	878-771-1	Spring (48.5 x 120) (8.5)	1
			1

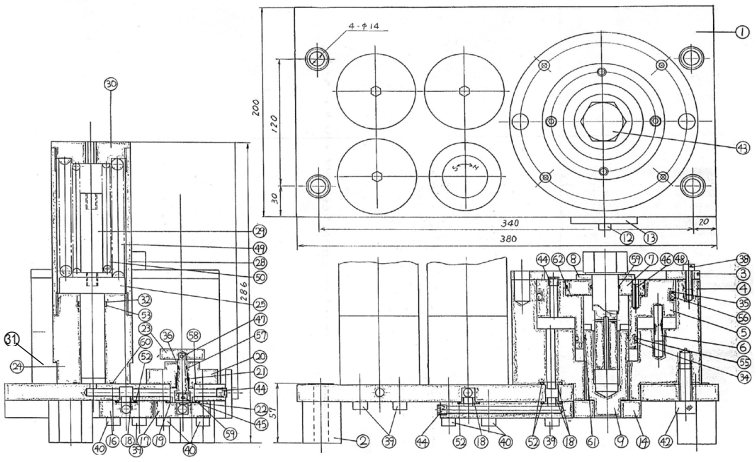
UFT Joint Simulator: Breakdown of the UFT-16 Joint Simulator



Index No.	Code No.	Description	Qty.
1	840-965-6	Setting Stand	1
2	840-718-6	Setting Plate	1
3	840-286-6	Cylinder	1
4	840-600-6	Plunger	1
5	840-318-6	Pilot Pin	4
6	840-049-5	Pressure Gauge Stand Screw	1
7	840-674-6	Cylinder Bushing	1
8	840-604-6	Plunger Bushing (M16)	1
9	840-359-6	Spindle Nut (M16)	1
10	840-676-5	Cylinder Liner	2
11	840-546-5	Piston	2
12	840-905-5	Cylinder Liner Casing	2
13	840-164-5	Spring Setter	2
14	840-175-5	Spring Setter Bushing	2
15	840-906-5	Cylinder Liner Casing Cover	2
16	840-567-6	Bushing	2
17	840-107-5	Selecting Dial	1
18	840-014-5	Valve Body	1
19	840-100-5	Valve	1
20	840-027-6	Separator	1
21	944-005-0	Back-up Ring (4.2 x 6 x 1)	1
22	944-011-0	Back-up Ring (P9)	4
23	944-017-0	Back-up Ring (P14)	2
24	944-032-0	Back-up Ring (P32)	1
25	944-070-0	Back-up Ring (P70)	1
26	945-214-0	Allen Head Bolt (M6 x 14)	2
27	945-235-0	Allen Head Bolt (M6 x 35)	4
28	945-320-0	Allen Head Bolt (M8 x 20)	7
29	945-425-0	Allen Head Bolt (M10 x 25)	2
30	945-967-0	Hexagon Round Head Bolt (M6 x 25)	4
31	946-975-0	Roll Pin (3 x 30)	1
31-1	975-557-0	Hexagonal Bolt (M16 x 50) (UFT)	1
32	966-110-0	Spacer (34 x 16.5 x 3) (H)	4
33	973-130-0	Allen Head Plug (NPT1/6)	1

Index No.	Code No.	Description	Qty.
34	973-216-0	Roll Pin (4 x 16)	1
35	976-764-0	Spring (49.5 x 120) (9.5)	2
36	979-312-0	Inner Snap Ring (ITRW-12)	1
37	990-007-0	O-Ring (P9)	4
38	990-014-0	O-Ring (P14)	2
39	990-032-0	O-Ring (P32)	1
40	990-055-0	O-Ring (P70)	1
41	990-904-0	O-Ring (SNS-6)	7
42	990-907-0	O-Ring (SNS-9)	1
43	990-908-0	O-Ring (SNS-10)	4
44	990-913-0	O-Ring (SNS-15)	4
45	990-914-0	O-Ring (SNS-16)	1
46	990-923-0	O-Ring (SNS-26)	1
47	990-937-0	O-Ring (SNS-46)	1
48	990-972-0	O-Ring (SNS-4) (NOK)	1
49	966-102-0	Allen Head Plug (3/8)	1
M14 Type			
51	878-777-1	Plunger Bushing (M14)	1
52	878-778-1	Spindle Nut (M14)	1
53	946-974-0	Hexagonal Bolt (M14 x 50) (UFT)	1
53-1	975-556-0	Spacer (30 x 14.5 x 3) (H)	1
54	976-763-0	Spring (49 x 120) (9.0)	2
55	990-912-0	O-Ring (SNS-14)	1
56	990-937-0	O-Ring (SNS-46)	1
M12 Type			
58	878-781-1	Plunger Bushing (M12)	1
59	878-782-1	Spindle Nut (M12)	1
60	946-973-0	Hexagonal Bolt (M12 x 45) (UFT)	1
60-1	975-555-0	Spacer (26 x 12.5 x 3) (H)	1
61	976-763-0	Spring (49 x 120) (9.0)	2
62	990-911-0	O-Ring (SNS-12)	1
63	990-937-0	O-Ring (SNS-46	1

UFT Joint Simulator: Breakdown of the UFT-24 Joint Simulator



Index No.	Code No.	Description	Qty.
1	840-718-7	Setting Stand	1
2	840-397-7	Setting Plate	1
3	840-285-7	Cylinder Rear Plate	1
4	840-286-7	Cylinder	1
5	840-600-7	Plunger	1
6	840-318-7	Pilot Pin	4
7	840-604-7	Plunger Bushing (M24)	1
8	840-357-7	Spindle Spacer (53 x 24.5 x 5) (H)	1
9	840-359-7	Spindle Nut (M24)	1
12	840-800-7	Socket Pin	1
13	840-521-7	Socket Plate	1
14	840-520-7	Socket	1
15	840-522-7	Socket Bushing	1
16	840-090-7	Air Inlet Bushing	1
17	840-098-7	Air Inlet Bushing (B)	1
18	840-567-7	Bushing	1
19	840-101-7	Valve Bushing	1
20	840-014-7	Valve Body	1
21	840-114-7	Valve Spindle	1
22	840-100-7	Valve	1
23	840-107-5	Selecting Dial	1
24	840-676-7	Cylinder Liner	1
25	840-546-7	Piston	1
26	840-675-7	Cylinder Liner	2
27	840-545-7	Piston	2
28	840-905-7	Liner Casing	3
29	840-547-7	Piston Rod	3
30	840-906-7	Liner Casing Setter	3
31	966-101-0	Allen Head Plug (1/4)	1
32	944-021-0	Back-up Ring (P22)	1
33	944-026-0	Back-up Ring (P25)	2
34	944-048-0	Back-up Ring (P50)	1
35	944-155-0	Back-up Ring (P115)	1
36	944-206-0	Back-up Ring (6.1 x 8 x 1)	1
37	945-212-0	Allen Head Bolt (M6 x 12)	2
38	945-216-0	Allen Head Bolt (M6 x 169)	4
39	945-330-0	Allen Head Bolt (M8 x 30)	10
40	945-342-0	Allen Head Bolt (M8 x 45)	10
41	945-429-0	Allen Head Bolt (M10 x 35)	2
42	945-446-0	Allen Head Bolt (M12 x 30)	4
43	946-978-0	Hexagon Head Bolt (M24 x 90) (UFT)	1
44	966-100-0	Allen Head Plug (1/8)	6

Index No.	Code No.	Description	Qty.
45	973-112-0	Roll Pin (3 x 12)	1
46	973-124-0	Roll Pin (3 x 24)	1
47	973-130-0	Roll Pin (3 x 30)	1
48	973-322-0	Roll Pin (5 x 24)	1
49	976-775-0	Spring (59 x 115) (11.0)	3
50	976-716-0	Spring (35 x 105) (7.0)	3
51	979-407-0	Outer Snap Ring (E4)	1
52	990-014-0	O-Ring (P14)	4
53	990-020-0	O-Ring (P22)	1
54	990-013-0	O-Ring (P25)	3
55	990-046-0	O-Ring (P50)	1
56	990-115-0	O-Ring (P115)	1
57	990-904-0	O-Ring (SNS-6)	1
58	990-919-0	O-Ring (SNS-22)	1
59	990-917-0	O-Ring (SNS-24)	2
60	990-924-0	O-Ring (SNS-30)	3
61	990-929-0	O-Ring (SNS-36)	1
62	990-991-0	O-Ring (SNS-67)	1
63	878-877-1	Test Socket (3/4SQ x 36) (M24)	1
M20 Type			
64	878-785-1	Plunger Bushing (M20)	1
65	878-786-1	Spindle Spacer (44 x 20.5 x 4) (H)	1
66	878-787-1	Spindle Nut (M20)	1
67	946-977-0	Hexagon Head Bolt (M20 x 85) (UFT)	1
68	976-717-0	Spring (35.5 x 105) (6.5)	3
69	990-918-0	O-Ring (SNS-20)	1
70	990-929-0	O-Ring (SNS-36)	1
71	990-991-0	O-Ring (SNS-67)	1
72	878-874-1	Test Socket (3/4SQ x 30) (M20)	1
M18 Type			
73	878-790-1	Plunger Bushing (M18)	1
74	878-791-1	Spindle Spacer (40 x 18.5 x 4) (H)	1
75	878-792-1	Spindle Nut (M18)	1
76	946-792-0	Hexagon Head Bolt (M18 x 80) (UFT)	1
77	990-916-0	O-Ring (SNS-18)	1
78	990-929-0	O-Ring (SNS-36)	1
79	990-991-0	O-Ring (SNS-67)	1
80	878-871-1	Test Socket (3/4SQ x 27) (M18)	1

UFT Joint Simulator: Maintenance

1. Inspect the Bolt and Spindle Nut every 50,000 cycles.

2. Should the Plunger not come back up to the top of the Cylinder, then the tester is low on fluid. To fill the tester with fluid, the tester must be level.

   - Remove the two oil filler plugs from the plunger.
   - Pull the plunger back up to the top of the cylinder.
   - While holding the plunger up, fill the tester up through the filler holes with Dextron II.
   - Reinstall the oil filler plugs.

3. If the Plunger continues to stay down, the tester has a damaged seal and must be repaired. After the damaged parts are replaced, follow the same fill procedures as above.

UFT Joint Simulator: Certification of the UFT Joint Simulator

The UFT tester should be certified every 5,000 cycles.

Certification Procedures

1. On the chart below, find the UFT model you are certifying.
2. Next, find the bolt size.
3. With a torque wrench, tighten to the recommended snug torque.
4. Turn the torque wrench the number of degrees recommended from snug for each joint. The torque reading should be the same as shown on the chart.
5. If the readings do not match, the Test Bolt might be worn. Replace the Test Bolt and re-certify the tester. If the tester still does not match the chart, check the fluid level and/or all O-Rings and Supporter Rings for wear.

Torque Values for Certifying Tester

Model	Bolt Size	Snug Point Torque		B Joint at 60° from Snug		C Joint at 180° from Snug		D Joint at 180° from Snug	
		ft. lbs.	Nm	ft. lbs.	Nm	ft. lbs.	Nm	ft. lbs.	Nm
UFT-S10		2		5.2-7.7	7.1-10.4	5.9-9.2	8.0-12.4	3.0-4.5	4.1-6.1
	M6	2.71		11.2-16.8	15.2-22.8	11.2-16.8	15.2-22.8	6.6-9.8	8.9-13.3
	M8	5.5 7.46		19.5-29.2	26.4-39.6	18.6-27.9	25.2-37.8	12.5-18.8	17.0-25.5
UFT-S16	M10	11	15	34.5-51.8	46.8-70.2	41-61.5	55.6-83.4	23.6-35.4	32.0-48.0
	M12	20.25		54.9-82.4	74.4-111.6	51.9-76.4	70.3-103.5	35.4-53.3	48.0-72.0
	M14	27.4		88.6-132.8	120-180	83-122.6	112.5-166.1	57.3-85.9	77.6-116.4
	M16	32.5 54.25 73.5	44						

		60° from Snug		180° from Snug	
		2.4-3.6	3.3-4.9	2.9-4.3	3.9-5.8
UFT-6	M5	5-7.5	6.8-10.2	6.5-9.7	8.8-13.2
UFT-10	M6	1.8	2.5	5-7.5	6.8-10.2	5.2-7.9	7.1-10.7
	M6	3.7	5.0	9.4-14.2	12.8-19.2	10.3-15.5	14-21
	M8	3.7	5.0	18.9-28.3	25.6-38.4	19.2-28.8	26-39
UFT-16	M10	5.75	7.8	37.8-56.8	51.2-76.8	37.8-56.8	51.2-76.8
	M12	11.5		61.4-92.1	83.2-124.8	61.4-92.1	83.2-124.8
	M14	15.2		76.7-115.1	104-156	79.7-119.6	108-162
UFT-24	M16	20.25		129.9-195.6	176-265	135.8-203.7	184-276
	M18	27.4		200.7-301.1	272-408	211.7-318.8	288-432
	M20	32.5	44	301.1-451.6	408-612	307-460.5	416-624
	M24	50.5 68.5		460-690	624-936	422-708	640-960
UFT-33									

UFT Joint Simulator: List of Hexagon Head Bolts

For UFT Joint Simulators

MODEL	PART NUMBER	BOLT SIZE
UFT-6	946-967-0	M4
UFT-6	946-968-0	M5
UFT-6	946-969-0	M6 x 18
UFT-S10	946-970-0	M6 x 30
UFT-S10	946-971-0	M8 x 32
UFT-S10	946-972-0	M10 x 35
UFT-10	946-970-0	M6 x 30
UFT-10	946-971-0	M8 x 32
UFT-10	946-972-0	M10 x 35
UFT-S16	946-973-0	M12 x 45
UFT-S16	946-974-0	M14 x 50
UFT-S16	946-975-0	M16 x 50
UFT-16	946-973-0	M12 x 45
UFT-16	946-974-0	M14 x 50
UFT-16	946-975-0	M16 x 80
UFT-24	946-976-0	M18 x 80
UFT-24	946-977-0	M20 x 85
UFT-24	946-978-0	M24 x 90

Utility Cart: Safety Precautions

FOR SAFETY:

1. Do not Operate, maintain or service machine:
    - Unless trained and authorized.
    - Unless operation manual is read and understood.
    - In flammable or explosive areas
2. Before operating machine:
    a. Make sure all safety devices are in place and operate properly.
3. When maintaining or servicing machine:
    - Disconnect battery connections before working on machine.
    - Avoid contact with battery acid.
    - Avoid moving parts. Do not wear loose jackets, shirts, ties, or sleeves when working on machine.
4. Do not transport machine with charger plugged in.

WARNING:
Batteries emit hydrogen gas. Explosion or fire can result. Keep sparks and open flame away. Keep covers open when charging

ATTENTION:
The battery charger supplied with the machine shall be grounded while in use to protect the operator from electric shock. This charger is designed for use on a nominal 120 volt circuit and has a grounding plug that resembles the plug illustrated. Make sure the charger is connected to an outlet having the same configuration as the plug. No adapter should be used with this charger. The green conductor in the cord is the ground wire. Never connect this wire to the other than the grounding pin of the attachment plug.

Store the machine indoors, do not expose to rain. This product is intended for commercial use.

Utility Cart: General Specifications

Electric 24 V DC-(2) 12V batteries
Charger, 110 VAC, 60 HZ/220 VAC

POWER TRAIN/PROPELLING SYSTEM
24 V DC Electric motor
24 V DC controller

SUSPENSION SYSTEM
Casters-(1) rear, 5 in. (127 mm) dia.
Drive-(2) front, 10 in. (25 4mm) dia.

GENERAL MACHINE DIMENSIONS
Length-36.0 in. (914 mm)
Width-20.5 in. (521 mm)
Height-41.4 in. (1042 mm)

MACHINE
Total weight, with batteries-300 lb.

Utility Cart: Additional Specifications

Additional Specifications

Nominal Power	1/2 hp (.373 kW)
Mass of Most Useful configuration	656 lbs. (300 kg)
Maximum drawbar pull	300 lbs. (136 kg)
Maximum Vertical load	200 lbs. (90 kg)

Utility Cart: Use of Machinery

The PartsCaddyLite is used from moving materials, parts, or machinery from one location to another without having to manually carry the load or push it on some wheeled cart. These applications can occur anywhere, from moving linen throughout a hotel, to moving materials off a dock at a marina, to distributing the company coffee machine around the plant.

Utility Cart: Adjustments

Controls:
The handle assembly can easily be adjusted if the machine comes out of neutral and begins to creep. By removing the (4) 5/16" self-threaded screws in the yellow control box, you will gain access to the control potentiometer. Adjust the potentiometer with a ½ inch SAE wrench. Turning the potentiometer towards the front of the machine will stop the machine from creeping backwards. Turning the potentiometer towards the rear of the machine will stop the machine from creeping forward.

Utility Cart: Installing Batteries

1. Make sure the power switch is in the off (O) position.
2. Using the lift handles provided on the battery, place batteries in the machine with the terminal posts as shown.

FOR SAFETY:
When maintaining servicing the machine.

- Battery acid can cause burns. Avoid contact with battery acid.
- When working on or around batteries, wear protective clothing, gloves, and safety glasses.
- Do not lay metal tools or metal objects on top of the batteries.
- Only install deep cycle marine style lead acid batteries in your Cart Caddy. The charger is built specifically for lead acid batteries. Any other battery may become overcharged and cause serious damage to the machine or operator
- When replacing batteries, you should replace all three batteries. This will assure the batteries will be kept in sync.

3. Remove the wing nuts from the terminal posts as shown.
4. **Make sure to attach the positive leads to the positive terminals.** Place the wing nuts on the terminal and tighten securely.

Utility Cart: Accessory Panel

A. Power Switch
The Power switch controls the machine power.
Turn the key to (1) to turn on the machine power.
Turn the key to (O) to turn off the machine power.
The machine batteries must be charged for the machine to have power.

B. Main Circuit Breaker
The main circuit breaker protects the motor from over load. If the load is too high, the main circuit breaker will trip and the unit will stop. To reset the circuit breaker, press the circuit breaker reset button on the circuit breaker. It may be necessary to allow the circuit breaker to cool down before resetting, or it may trip again. Reduce the load before resuming. Please review the load limit sections for recommended load limits.

C. Accessory Circuit Breaker
The circuit breaker protects control circuit from overload.

D. Voltmeter
The voltmeter shows the state of charge of the batteries.

E. Speed Dial
The speed dial allows you to adjust the speed control limit from slow to fast.

Utility Cart: Pre-Operation Checklist

Before operating the machine:

1. Make sure the charger is in OFF by unplugging the AC power cord from the wall outlet.
2. Lower the machine cover.
3. Make sure all controls are free and clear of any obstructions.
4. Turn the power switch on.
5. Make sure the emergency stop switch is working correctly. (Optional)
6. Make sure the safety light is operating correctly. (Optional)
7. Make sure the speed control switch is either in fast or slow speed.
8. Now you are ready to operate. If any of the safety features were not operating correctly please contact:
    - Your Manager
    - Maintenance Personnel
    - Your Service Representative
    - DJ Products, Inc.

Utility Cart: Maintenance

The Daily and Monthly maintenance requirements listed here may be performed without tools by the machine operators. Instructions for these maintenance requirements are provided in this section of the manual.

DAILY:
Perform all duties listed under the PRE-OPERATION check lists.

EVERY THREE MONTHS:
Lubricate castor bearings with grease.
Check and tighten all fasteners and hardware.
Clean, tighten and lubricate battery posts and cables.
Check transaxle for leaks, fill to level if required.

Utility Cart: Charging Batteries

The batteries have approximately an eight hour run time when fully charged. The batteries take about eight hours to charge after they have been fully discharged.

The battery charger has an automatic timer that will turn off the charger when the batteries read full charge.

The batteries should be charged after every eight hours of operation of the machine.

To charge the batteries:

1. Move the machine to a flat, dry surface in a well ventilated room.
2. Open the machine cover.
3. Check the water level in all the battery cells. If the level is low, add just enough distilled water to cover plates. DO NOT OVERFILL.
4. Wipe off tops of batteries with a cloth.
5. Connect this charge to the machine.
6. Plug the charger into a wall outlet.

Utility Cart: Service Policy

Whenever ordering parts or requesting any type of service, please specify:

1. The model of the machine
2. Serial number
3. The part number
4. The part description

Utility Cart: Load Limits

The PartsCaddyLite is specifically designed for moving materials, parts, or machinery. You should never operate the PartsCaddyLite:

- With an operator under the age of 16 years of age.
- With an operator sitting or riding on the PartsCaddyLite.
- With added weight not specifically added by DJ Products, Inc. or a certified service rep.
- With the door in an open position.
- Without being properly trained by a supervisor.
- In severe weather.
- With a known feature not working correctly.
- While on specific medicine that may impair your vision or reflexes.

By disregarding any of these limits, it may cause damage to the operator, your customer and the customers' vehicles, the PartsCaddyLite, and your building.

Disregarding any of these limits will void your warranty in case the PartsCaddyLite is damaged.

Limited Warranty Program

DJ PRODUCTS INC.

IMPORTANT: Read this entire Limited Warranty before using the PartsCaddyLite™ product. The PartsCaddyLite™ product (or other DJ Products Inc. product-collectively referred to herein as the "Product") manufactured by DJ Products Inc., a Minnesota corporation ("Manufacturer") is believed to be reliable if the directions for its use, maintenance and operating procedures are followed carefully. However, it is impossible to eliminate all risks inherently associated with the use of this product. Risk of failure, including personal injury, dismemberment, injury to property or even death, may result from misuse, abuse, neglect, negligent use, accidental or intentional damage, ordinary wear and tear, violation or omission of standard operating procedures, improper maintenance, failure to perform routine and preventative maintenance, alterations, additions and/or modifications to the Product, use by any individual not a fully trained and filly authorized operator, and improper training of the operator, all of which are beyond the control of the Manufacturer. All such risks are fully assumed by the purchaser/customer of the Product ("Customer").

Manufacturer offers a limited warranty (the "Limited Warranty") to each Customer who is the original purchaser of this Product that, effective for a period one year ("Limited Warranty Period") from the date of delivery of the Product to the Customer, that the Product is free from defects in material or workmanship in normal use and service. Should any Product prove not to conform to the foregoing Limited Warranty, the remedies of Customer for any breach of the foregoing Limited Warranty shall be limited to the repair of replacement of the Product. IN NO EVENT SHALL MANUFACTURER'S OBLIGATIONS PURSUANT TO THIS LIMITED WARRANTY EXCEED THE PURCHASE PRICE PAID TO THE MANUFACTURER BY THE CUSTOMER FOR THE PARTICULAR PRODUCT INVOLVED, TO THE EXCLUSION OF ALL OTHER REMEDIES OR LIMITATIONS, INCINDENTAL OR CONSEQUENTIAL DAMAGES. The Limited Warranty, which is the Customer's EXCLUSIVE REMEDY, shall be FURTHER LIMITED as follows:

1. If the defect in material or workmanship is disclosed to the Manufacturer by the Customer within the first ninety (90) days following delivery of the product to the Customer, the Limited Warranty shall be the full cost of the labor and parts to repair or replace the defective Product component parts thereof.

2. If the defect in material or workmanship is disclosed to the Manufacturer by the Customer prior to the expiration of the Limited Warranty Period but more than ninety (90) days following delivery of the Product, the Limited Warranty shall be the Manufacturer's cost of the replacement parts (excluding repair labor) required to repair the defective Product or component part.

Any warranty repair or replacement of Products or defective component parts shall occur at the Manufacturer's (or authorized service provider's) place of business. In order to obtain warranty service, the Customer must return the defective Product to the Manufacturer within the Warranty Period, together with proof of purchase by Customer establishing date of delivery, with freight charges and applicable costs of repair, if any, prepaid, which Product the Manufacturer shall have determined to its satisfaction, after examination, to have been defective. The Manufacturer shall ship, prepaid, any repaired or replaced Product covered by the Limited Warranty, to the Customer's facility located within the continental United States.

The Limited Warranty is invalid if the factory-applied serial number has been altered or removed from the Product. The Limited Warranty does not cover cosmetic damage or damage due to acts of God, accident, misuse, abuse, neglect, negligent use, accidental or intentional damage, ordinary wear and tear, violation or omission of standard operating procedures, improper maintenance, failure to perform routine and

preventative maintenance, alterations, additions and/or modifications to the Product, use by any individual not a fully trained and fully authorized operator, and improper training of the operator, or repair or attempted repair by anyone other than Manufacturer or its authorized agents, nor to any Product which is leased or used as rental equipment. The occurrence of any foregoing voids the Limited Warranty.

This Limited Warranty does not cover Customer instruction or training.

THIS LIMITED WARRANTY PROGRAM IS EXCLUSIVE AND IS GIVEN AND ACCEPTED IN LIEU OF ANY AND ALL OTHER WARRANTIES, WHETHER WRITTEN OR ORAL, EXPRESSED OR IMPLIED OR INFERABLE FROM THE COURSE OF DEALING OR USAGE OF TRADE, INCLUDING, WITHOUT LIMITATION, THE IMPLIED WARRANTY OF MERCHANTABILITY AND THE IMPLIED WARRANTY OF FITNESS FOR A PARTICULAR PURPOSE AND ANY IMPLIED WARRANTY ARISING FROM THE PERFORMANCE, COURSE OF DEALING OR USAGE OF TRADE, AND ALL OTHER OBLIGATIONS, LIABILITIES, RIGHTS, CLAIMS OR REMEDIES, INCLUDING ANY RIGHT IN CONTRACT, TORT, STRICT LIABILITY OR ANY RIGHT ARISING FROM MANUFACTURER'S NEGLIGENCE, ACTUAL OR IMPUTED. FOR CLARIFACTION ONLY (AND NOT IN ANY WAY TO EXPAND THE FOREGOING EXCLUSIVE REMEDIES):

(A) UNDER NO CIRCUMSTANCES WILL MANUFACTURER BE LIABLE FOR LOST PROFITS OR ANY OTHER INCIDENTAL, CONSEQUENTIAL, SPECIAL OR INDERECT DAMAGES RESULTING FROM THE PURCHASE OR USE OF THIS PRODUCT, INCLUDING, WITHOUT LIMITATION, ECONOMIC LOSS, COST OF CAPITAL, CLAIMS OF CUSTOMERS FOR FAILURE OF SUPPLY OR LOSS OF USE OR DAMAGE TO PERSONS OR TO OTHER PROPERTY , NOT WITHSTANDING THE FACT THAT THE MANUFACTURER HAS BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGES; (B) THE TOTAL LIABILITY OF THE MANUFACTURER TO CUSTOMER SHALL NOT EXCEED TO TOTAL PURCHASE PRICE PAID BY THE DISTRIBUTOR TO MANUFACTURER FOR THE PARTICULAR PRODUCT INVOLVED; AND (C) NO AGREEMENT VARYING OR EXTENDING THE FOREGOING WARRANTIES, REMEDIES OR LIMITATIONS WILL BE BINDING UPON THE MANUFACTURER UNLESS INN WRITING AND SIGNED BY A DULY AUTHORIZED CORPORATE OFFICER OF THE MANUFACTURER.

If any term or condition of this Limited Warranty program is in violation of applicable local, state, or federal law, this Limited Warranty program shall not be voided in its entirety, but rather, the court, or other appropriate authority having jurisdiction in the matter, shall rewrite and reform the Limited Warranty to the minimum extent required so as permitted under applicable law.

Utility Cart: Operating and Training Instructions

Please make as many copies as needed for training purposes.

1) Operator as been shown and understands that the key switch and the safety stop switch must be turned on and the battery indicator gauge must be in the green/white position before the PartsCaddyLite will operate.

X_____

2) Operator has been shown and understands that the PartsCaddyLite had variable speed handlebar twist grips that will operate the unit between 0-3 mph forward and 0-1.5 mph backward. He/She understands that either allowing the handlebars to spring back to neutral or pushing the safety stop switch will stop the unit and the load. The unit also has a speed gauge that limits high-end speed and power.

X_____

3) Operator has been shown and understands that turning the handlebars left or right turns the PartsCaddyLite, and thus turns the load. He/She understands that you should have two hands on the handlebars when pushing the load, and walk along side the PartsCaddyLite with one hand on the handlebars when pulling a load.

X_____

4) Operator has been shown and understands that when the safety stop switch bumps into the operator and is depressed, the unit stops. The unit will not travel forward, only backwards in a slow manner as to unpin the operator if necessary. He/She must twist the safety stop switch in a clockwise direction to release the switch before the unit becomes fully operational again.

X_____

5) Operator has been shown and understands that when the battery gauge is in the red, it should be plugged into the automatic charger until the unit is fully charged. The automatic charger must be unplugged and the gauge fully back in the green/white before he PartsCaddyLite is put back into operation.

X_____

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