

# ***SPECIAL REPORT ON CONTACT RETENTION TESTING***

**Date: June 12, 2009**  
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**PURPOSE:** This document is intended to aid in the use and selection of tooling used for the purpose of testing contact retention at the wire harness assembly/maintenance level (in-process). It is supplemental to the product literature (see Appendix 1), data/instruction sheets (see Appendix 2), and other documentation that may be supplied with the testers.

The purpose of "HT250" series testers manufactured by DMC is to verify the proper seating of contacts in connectors. The minimum pressure required to move an unseated contact should be used to avoid the possibility of damage to the connector or contact being tested.

**QUALIFICATION TESTING OF CONNECTORS:** The "HT250" series testers are not intended to test contact retention to MIL-STD-1344, Method 2007-1 (See Appendix 4) superseded by EIA 364-29.

This Method is a requirement for qualification testing by the connector manufacturer, and is not suitable for in-process wire harness assembly/maintenance use. The forces specified in connector specifications for this type of testing are extreme, and will impose damage to contacts, and possibly to connectors. Method 2007-1 requires fixturing to hold the connector, contact, and test instrument in correct alignment when the pressure is applied. "HT" series testers are handheld, and do not provide alignment fixturing.

**PROCEDURE:** Select the tool that best conforms to the test force range and the correct tip to match the contact being tested (be aware that some connectors contain a mix of contact sizes). Install the tip into the retention tester, replacing and discarding the shipping screw. Follow the instructions supplied with the tool (See Appendix 2). Inspect the position of the contacts in the connector. If any have moved out of the correct position, this would indicate a failure, and rework is necessary.

**CALIBRATION:** The "HT250" series testers are intended for reference force testing. Although they are very repeatable and dependable, there is no specified tolerance on the force applied by the tool. The tolerance span of the tool is based on the accuracy of the calibration device and method used to calibrate the tester. When the testers are manufactured by DMC they are set to the mid scale value or to the purchase order specified force using a specially designed calibration instrument (part number RTCG-75, accuracy 0.5% full scale to 75 pounds force). (see Appendix 5).

1. Remove the handle and clamp the HT250-X retention tester into the fixture (with the adjustment locking nut loosened or removed). The compression wheel is rotated until the center of the indicator line is aligned with the sliding cover.
2. The adjustment screw is then rotated until the desired force is indicated on the calibrated force gauge that is part of the fixture.
3. The retention tester is then removed from the fixture and exercised a few times by compressing the spring in the tester and relaxing it.
4. The retention tester is then reinstalled in the fixture. The setting process is repeated for verification.
5. If the desired force is shown on the calibrated force gauge when the sliding cover is aligned with the center of the indicator line, the adjustment is locked into place by rotating the jam nut, and binding the adjustment screw on the top of the retention tester.
6. The handle is replaced to conceal the adjustment screw and lock nut. The setting may be made "tamper-proof" by affixing a label or seal to the handle and body so it would require breaking the label to remove the handle.

If precision and accuracy are not required, an alternate setting method for the HT250 series retention testers would be to hold the tool vertical on a calibrated weight scale and perform the setting and verification steps as defined in steps 1-6 above.

**CAUTION:**

Do not use a hand held retention testing device at forces higher than those necessary to move an unseated contact.

Maintain proper alignment to the contacts when using retention tools. Be sure all force is applied in-line with the contact under test.

Always match the tip size and gender to the contact size correctly.

Never exceed the preset force of the tool by allowing the sliding cover to travel past the indicator line.

Get special instructions and tips (if required) to test retention of coaxial contacts, shielded or multi-conductor contacts, or fiber optic termini.

**SUMMARY:**

The HT250 series retention testers are intended to be used as a reliable instrument for in-process testing of the correct and complete installation of contacts. When minimal forces are used, and employees are properly trained in the use, selection, and calibration, the HT250-X retention testers provide an economical solution to a common quality/reliability weakness in the wire harness industry.

For additional information contact Daniels Manufacturing Corporation, Orlando, Florida (USA).

## APPENDIX 1

### CONTACT RETENTION TEST TOOLS



**Typical application showing tool testing pin contacts.**

The quality assurance test most often overlooked is retention (proper seating of contacts). This important test can now be performed simply and in a matter of seconds with the DMC retention testing tools.

These tools are for checking the retention of pins and sockets in electrical connectors. The tester pin and socket tips are aluminum. All tips are replaceable.

A nylon hand protector is provided with each tool. The tools can be preset at the factory to your request.

Insert tester into a contact so that the tester and contact are in a straight line.

Hold in this position throughout the testing procedure. Use pin end with socket and socket end with pin. Apply pressure to tester until the indicator band is in-line with the body.

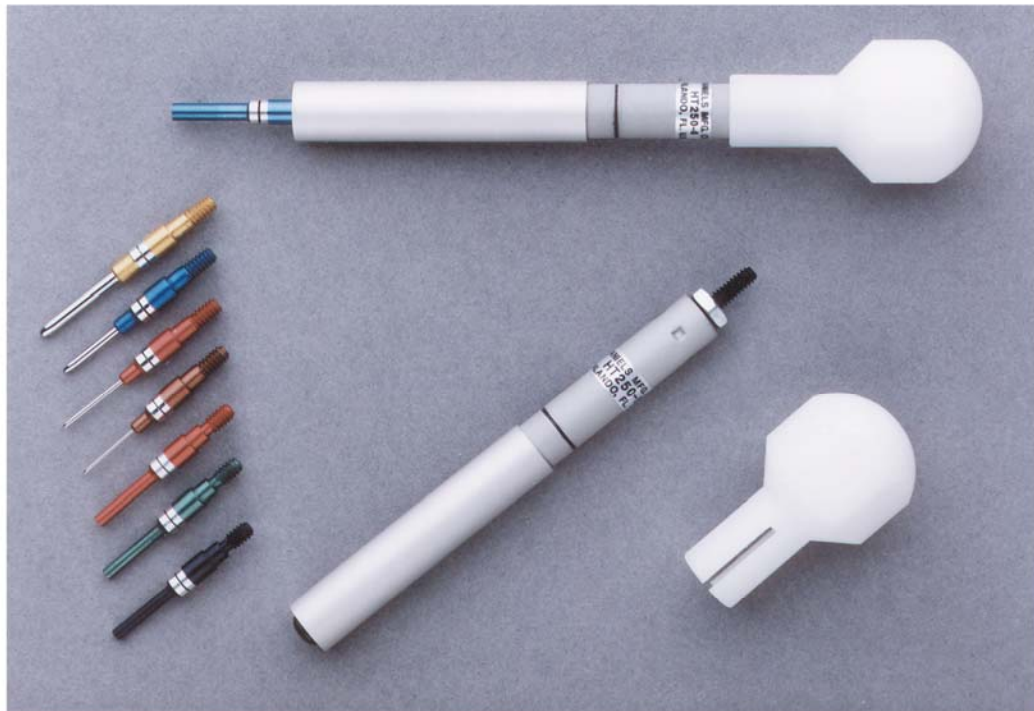
If contact is still firmly retained, the retention is satisfactory.

#### Connector Series Served

MIL-C-5015	MIL-C-38999
MIL-C-24308	MIL-C-81511
MIL-C-26482	MIL-C-81659
MIL-C-26500	MIL-C-81703
MIL-C-28748	MIL-C-83723

Proprietary and other military connector series may be serviced by DMC retention testers. Please consult DMC for verification

**NOTE:** Retention test tools are to be used as a simple indicator to verify contact locking. Retention testing to MIL-STD-1344 (method 2007.1) will require different test equipment. For additional information, please consult DMC.



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# CONTACT RETENTION TEST TOOLS



## HT250 ADJUSTABLE RETENTION TEST TOOL

### TOOL SET UP

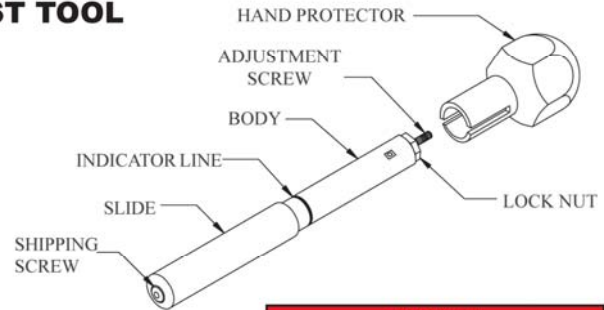
1. Tool part number designates tool body only, without tip. Refer to Chart A for preset range of tool.
2. Remove button head (shipping) screw. Select appropriate tip and screw into tool body through slide. Refer to Chart B for tip part numbers.

### USE OF TOOL (for 210, 240 and 250 tool series)

1. To test retention of socket contacts, use socket tester tip with preset tool. Insert tester (pin) into mating end of contact. Tool must be in a straight line with contact. For pin contacts, fit pin tester to tool body and place over contact at the mating end.
2. Apply pressure toward contact until slide aligns with indicator mark, contact should remain firmly in place.

### TOOL ADJUSTMENT

1. Remove hand protector, back off lock nut away from body of tool to allow free movement of adjustment screw.
2. Secure tool in RTCG-75 or equivalent setting gage for precise calibration. If precise calibration isn't required, you can set the tool by holding the tool firmly by hand on a scale or other weight indicating device, and apply axial force until the end of the slide is aligned with the indicator mark. Note reading of force on gage (or accurate weight-scale).
3. Adjust tool to required force by turning adjustment screw with a screwdriver, clockwise to increase force and counterclockwise to decrease force. When required value is achieved, tighten lock nut firmly while maintaining alignment of slide and indicator line. Tool is now set.
4. Note: Inspection stickers may be used to seal hand protector onto tool body, in order to signal any tampering with the adjustment screw.



**CHART A**

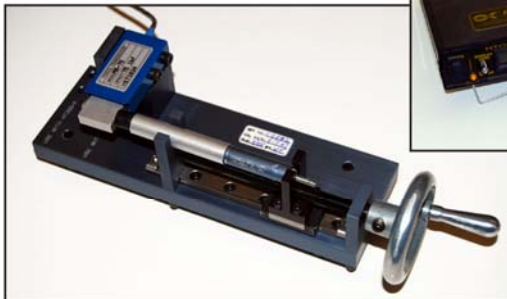
Handle P/N	Range LBS.
HT250-1	1.5 THRU 3.0
HT250-2	3.2 THRU 5.5
HT250-3	4.0 THRU 8.0
HT250-4	7.0 THRU 18.0
HT250-5	17.0 THRU 25.0
HT250-6	24.0 THRU 40.0
TIPS ARE ORDERED SEPARATELY	

**CHART B - TIP PART NUMBERS\***

CONTACT SIZE	COLOR CODE	SOCKET TESTER	PIN TESTER
12	YELLOW	67-012-01	68-012-01
16	BLUE	67-016-01	68-016-01
20	RED	67-020-01	68-020-01
22, 22M, 22D	COPPER	67-022-01	68-022-01
23	BLACK	67-023-01	68-023-01
* TIPS ARE ORDERED SEPARATELY FROM TOOL HANDLE			

**NOTE:** ADDITIONAL TIPS ARE AVAILABLE. PLEASE CONSULT ONE OF OUR CUSTOMER SERVICE REPRESENTATIVES.

RTCG-75  
Retention Tester Calibration Gage



### Optional Calibration Equipment

The DMC RTCG-75 calibration fixture is supplied to support in-house calibration of DMC HT250 Series Retention Testers. It incorporates the latest Alphatron® digital test technology, and is self-contained and portable.

The tester is supplied in a protective case with calibration certificate to NIST (accuracy 0.5% full scale to 75 pounds force).

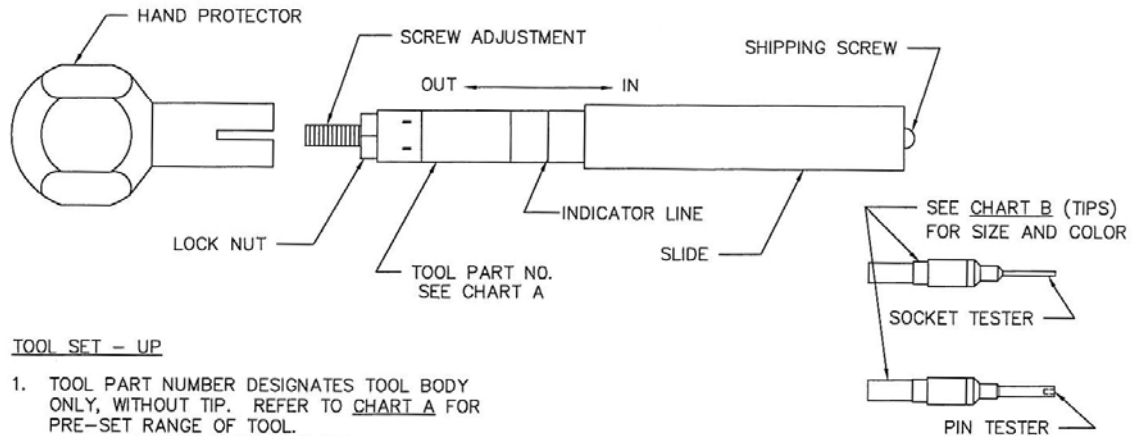
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## APPENDIX 2

### DANIELS HT250 CONTACT RETENTION TESTER ADJUSTABLE TOOL

**DMC** DANIELS  
MANUFACTURING  
CORPORATION  
**DATASHEET**

SEE REVERSE SIDE FOR IMPORTANT INFORMATION CONCERNING  
LIMITED WARRANTY, AND LIMITATION OF LIABILITY.



#### TOOL SET - UP

1. TOOL PART NUMBER DESIGNATES TOOL BODY ONLY, WITHOUT TIP. REFER TO **CHART A** FOR PRE-SET RANGE OF TOOL.
2. REMOVE BUTTON HEAD (SHIPPING) SCREW. SELECT APPROPRIATE TIP AND SCREW INTO TOOL BODY THROUGH SLIDE.

#### TOOL ADJUSTMENT

1. REMOVE HAND PROTECTOR, BACK OFF LOCK NUT AWAY FROM BODY OF TOOL TO ALLOW FREE MOVEMENT OF ADJUSTMENT SCREW.
2. SECURE TOOL IN RTCG-75 OR EQUIVALENT SETTING GAGE FOR PRECISE CALIBRATION. IF PRECISE CALIBRATION ISN'T REQUIRED, YOU CAN SET THE TOOL BY HOLDING THE TOOL FIRMLY BY HAND ON A SCALE OR OTHER WEIGHT INDICATING DEVICE, AND APPLY AXIAL FORCE UNTIL THE END OF THE SLIDE IS ALIGNED WITH THE INDICATOR LINE. NOTE READING OF FORCE ON GAGE (OR ACCURATE WEIGHT-SCALE).
3. ADJUST TOOL TO REQUIRED FORCE BY TURNING ADJUSTMENT SCREW WITH A SCREWDRIVER - CLOCKWISE TO INCREASE AND COUNTER CLOCKWISE TO DECREASE. WHEN REQUIRED VALUE IS ACHIEVED, TIGHTEN LOCK NUT FIRMLY WHILE MAINTAINING ALIGNMENT OF SLIDE AND INDICATOR LINE. TOOL IS NOW SET.
4. NOTE: INSPECTION STICKERS MAY BE USED TO SEAL HAND PROTECTOR ONTO TOOL BODY, IN ORDER TO SIGNAL ANY TAMPERING WITH THE ADJUSTMENT SCREW.

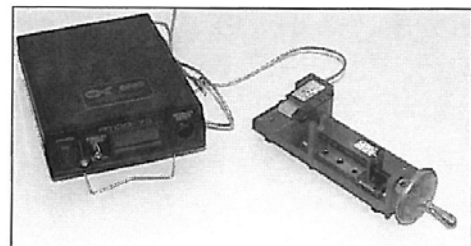
#### USE OF TOOL

1. TO TEST RETENTION OF SOCKET CONTACTS, USE THE SOCKET TESTER TIP WITH A PRESET TOOL. INSERT TESTER (PIN) INTO MATING END OF CONTACT. TOOL MUST BE IN A STRAIGHT LINE WITH CONTACT. FOR PIN CONTACTS, FIT PIN TESTER TO TOOL BODY AND PLACE OVER CONTACT AT THE MATING END.
2. APPLY PRESSURE TOWARD CONTACT UNTIL SLIDE ALIGNS WITH INDICATOR LINE. CONTACT SHOULD REMAIN IN PLACE.

**CHART A**

TOOL P/N	RANGE (LBS.)
HT250-1	1.5 THRU 3.0
HT250-2	3.2 THRU 5.5
HT250-3	4.0 THRU 8.0
HT250-4	7.0 THRU 18.0
HT250-5	17.0 THRU 25.0
HT250-6	24.0 THRU 40.0

**RTCG-75**



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CHART B

REPLACEMENT TIPS - IDENTIFICATION			
(CONTACT) SIZE	COLOR CODE	SOCKET TESTER	PIN TESTER
8	RED	67-008-01	68-008-01
12	YELLOW	67-012-01	68-012-01
16	BLUE	67-016-01	68-016-01
20	RED	67-020-01	68-020-01
22, 22M, 22D	COPPER	67-022-01	68-022-01
23	BLACK	67-023-01	68-023-01
26	GREEN	67-026-01	68-026-01

#### LIMITATION OF LIABILITY

DANIELS MANUFACTURING CORPORATION IS NOT LIABLE FOR CONSEQUENTIAL OR SPECIAL DAMAGES OF ANY NATURE OR KIND RESULTING FROM THE USE, OR MISUSE, OF ANY OF ITS PRODUCTS. OWNERS AND USERS OF DMC PRODUCTS ASSUME FULL RESPONSIBILITY FOR INSTRUCTING THEIR EMPLOYEES IN THE PROPER AND SAFE USE OF SUCH PRODUCTS.

#### LIMITED WARRANTY

DMC (Daniels Manufacturing Corporation) warrants each new product sold by it to be free from defects in material and workmanship under normal use and service. DMC's obligation under this warranty is limited to the free correction or, at DMC's option, the refund of the purchase price of any such product which proves defective in normal service within ninety (90) days after delivery to the first user, provided that the product is returned to DMC with all transportation charges prepaid and which shall appear to DMC's satisfaction, after DMC's inspection, to have been defective in material or workmanship, it being understood that DMC products are not consumer products. This warranty shall not cover any damage to any product which, in the opinion of DMC, was caused by normal wear, misuse, improper operation, tampering, neglect or accident. This warranty is in lieu of all other warranties express or implied. No warranty, express or implied, is made or authorized to be made or assumed with respect to products of Daniels Manufacturing Corporation other than those herein set forth.

## ***APPENDIX 3***

### **HT250 Lb, N, & Kg Force Ranges**

TOOL P/N	RANGE (Lb)	RANGE (N)	RANGE (Kg)
HT250-1	1.5 THRU 3.0	6.7 THRU 13.3	0.7 THRU 1.4
HT250-2	3.2 THRU 5.5	14.2 THRU 24.5	1.5 THRU 2.5
HT250-3	4.0 THRU 8.0	17.8 THRU 35.6	1.8 THRU 3.6
HT250-4	7.0 THRU 18.0	31.1 THRU 80.1	3.2 THRU 8.2
HT250-5	17.0 THRU 25.0	75.6 THRU 111.2	7.7 THRU 11.3
HT250-6	24.0 THRU 40.0	106.8 THRU 177.9	10.9 THRU 18.1

# **APPENDIX 4**

MIL-STD-1344A  
1 SEPT 1977

## **METHOD 2007.1**

### **CONTACT RETENTION**

1. **PURPOSE.** The purpose of this test is to impose axial forces on the connector contacts to determine the ability of the connector to withstand forces that tend to displace contacts from their proper location within the connector insert and resist contact pullout. These forces may be the result of:
  - a. Loads on wire connected to the contact.
  - b. Forces required to restrict contact "push-through" during assembly of removable type contact into connector inserts.
  - c. Forces produced by mating contacts during connector mating.
  - d. Dynamic forces produced by vibration and shock during normal use of the connectors.
  - e. Forces relating to bundling strains on the wire.
2. **TEST EQUIPMENT.** Equipment required to perform contact retention test shall be as follows:
  - a. Force gages, of suitable range for the contact size under test, so that readings shall lie in the middle 50 percent of the scale, where practical, with a nominal full scale accuracy of + 2 percent.
  - b. Dial indicator gages or other suitable instruments of such range for the contacts under test that the readings shall be in the middle 50 percent of the scale, with a nominal full scale accuracy of + 2 percent.
  - c. Contact removal and insertion tools, as required.
  - d. Suitable compression device.
  - e. Steel test probes, to adapt the force gage plunger to the particular contact (pin, socket, or hermaphroditic) from or wiring end under test.
3. **TEST SAMPLE.** A test sample shall consist of a plug or receptacle with suitable contacts in place. Unless otherwise specified, 20 percent of the contact complement, but not less than 3 contact of each size shall be tested.

3.1 **Preparation.** All backshell hardware and compression rings, if any, shall be removed . When the specification requires the contact retention to be tested from the wire side of the connector, contacts shall have the wires cut off flush or the contacts replaced as specified. All contacts shall be in the place. Simulated contact which duplicate the retention feature Geometry may be used in lieu of actual contacts to facilitate testing.

3.2 **Mounting.** The unmated connector shall be mounted in a position of axial alignment of the contacts with the plunger of the test gage. A minimum of ¼ -inch of space shall be provided on the opposite side under test to permit any "push-through" that may occur.

#### 4. **TEST PROCEDURES.**

4.1 **Test.** The contact retention test shall be applied to the sample contacts as follows.

a. Determine the direction (axially) in which the test shall be conducted from the detail specification. Apply a sufficient axial seating load ("push" force) to take up any slack of the contact in its retention system. Sudden or excessive loads shall not be applied.

b. Establish the reference (zero displacement) position of the contact. The contact may be lightly preloaded (3 pounds, maximum) to assure proper seating.

c. Apply an axial load to the contact at the rate of approximately 1 pound per second, until the specified force has been reached. The specified force shall be maintained for 5 to 10 seconds during which measurement of displacement shall be made or the lead shall be removed and the displacement measured, as specified.

d. If the test is required in two directions, repeat 4.1.a, b, and c form the second direction.

#### 5. **DOCUMENTATION.** Data sheets shall contain:

- a. Title of test, date, and name of operator.
- b. Sample description -Include fixture, if applicable.
- c. Test equipment used and date of latest calibration.
- d. Identification of test method.
- e. Vales and observations:

(1) Force applied (see 4.1 c)

(2) Measured contact displacement during application or after removal of specified force, as specified (see 4.1 c).

6. **SUMMARY.** The following details shall be specified in the individual specification:

a. Number of contact positions in sample to be measured, if other than as specified herein (see 3).

b. Removal of wires (see 3.1).

c. Axial direction in which test shall be conducted and whether in two directions (see 4.1 a and d).

d. Applied axial load (see 4.1 c)

e. Maximum allowable contact displacement during application of specified force and/or after removal of specified force (see 4.1 c).

f. Special requirements or precautions, if any.

## APPENDIX 5

***The RTCG-75 setting/calibration fixture used by DMC to set HT250 Retention Testers***

