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**AMPLIMITE\* HDP-20 Subminiature D Connector With F Crimp  
Contacts**

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**1. SCOPE**

## 1.1. Content

This specification covers the performance, test and quality requirements for the AMPLIMITE\* HDP-20 subminiature D connectors with removable F crimp contacts. The assembly consists of a two piece plastic housing which has integral plastic retention tines and two metal shells which secure the housing components.

## 1.2. Qualification

When tests are performed on the subject product line, the procedures specified in Figure 1 shall be used. All inspections shall be performed using the applicable inspection plan and product drawing.

## 1.3. Qualification Test Results

Successful qualification testing on the subject product line was completed on 06Oct89. The Qualification Test Report number for this testing is 501-99. This documentation is on file at and available from Engineering Practices and Standards (EPS).

**2. APPLICABLE DOCUMENTS**

The following documents form a part of this specification to the extent specified herein. Unless otherwise specified, the latest edition of the document applies. In the event of conflict between the requirements of this specification and the product drawing, the product drawing shall take precedence. In the event of conflict between the requirements of this specification and the referenced documents, this specification shall take precedence.

## 2.1. TE Connectivity (TE) Documents

- 114-40030: Application Specification (AMPLIMITE\* HDP-20 & Economy Crimp Snap Subminiature D Commercial Connectors)
- 501-99: Qualification Test Report (AMPLIMITE\* HDP-20 Subminiature D Connector With F Crimp Contacts)

## 2.2. Industry Standard

EIA-364: Electrical Connector/Socket Test Procedures Including Environmental Classifications

## 2.3. Reference Document

109-197: Test Specification (AMP Test Specifications vs EIA and IEC Test Methods)

**3. REQUIREMENTS**

## 3.1. Design and Construction

Product shall be of the design, construction and physical dimensions specified on the applicable product drawing.

3.2. Material

Materials used in the construction of this product shall be as specified on the applicable product drawing.

3.3. Ratings

- Voltage: 250 volts AC
- Current: Fully loaded and energized connectors, see Figure 4
  - 18 AWG: 3.1 amperes
  - 22 AWG: 2.0 amperes
  - 28 AWG: 1.2 amperes
- Temperature: -55 to 105°C

3.4. Performance and Test Description

Product is designed to meet the electrical, mechanical and environmental performance requirements specified in Figure 1. Unless otherwise specified, all tests are performed at ambient temperature.

3.5. Test Requirements and Procedures Summary

Test Description	Requirement	Procedure																					
Examination of product.	Meets requirements of product drawing and Application Specification 114-40030.	EIA-364-18. Visual and dimensional (C of C) inspection per product drawing.																					
Final examination of product.	Meets visual requirements.	EIA-364-18. Visual inspection.																					
<b>ELECTRICAL</b>																							
Low level contact resistance.	15 milliohms maximum.	EIA-364-23. Subject specimens to 100 milliamperes maximum and 20 millivolts maximum open circuit voltage. See Figure 3.																					
Contact resistance, specified current.	<table border="1" style="display: inline-table; border-collapse: collapse;"> <thead> <tr> <th>Wire Size (AWG)</th> <th>Test Current (amperes)</th> <th>Resistance Maximum (milliohms)</th> </tr> </thead> <tbody> <tr><td>18</td><td>3.1</td><td>15</td></tr> <tr><td>20</td><td>2.4</td><td>15</td></tr> <tr><td>22</td><td>2.0</td><td>15</td></tr> <tr><td>24</td><td>1.6</td><td>15</td></tr> <tr><td>26</td><td>1.3</td><td>15</td></tr> <tr><td>28</td><td>1.2</td><td>15</td></tr> </tbody> </table>	Wire Size (AWG)	Test Current (amperes)	Resistance Maximum (milliohms)	18	3.1	15	20	2.4	15	22	2.0	15	24	1.6	15	26	1.3	15	28	1.2	15	EIA-364-6. Measure potential drop of mated contacts assembled in housing. Calculate resistance. See Figure 3.
Wire Size (AWG)	Test Current (amperes)	Resistance Maximum (milliohms)																					
18	3.1	15																					
20	2.4	15																					
22	2.0	15																					
24	1.6	15																					
26	1.3	15																					
28	1.2	15																					
Insulation resistance.	5000 megohms minimum initial. 500 megohms minimum final.	EIA-364-21. Test between adjacent contacts of unmated specimens.																					
Withstanding voltage.	One minute hold with no breakdown or flashover. 0.5 milliampere maximum leakage current.	EIA-364-20, Condition I. 1000 volts AC at sea level. Test between adjacent contacts of unmated specimens.																					

Figure 1 (continued)

Test Description	Requirement	Procedure																								
Temperature rise vs current.	30°C maximum temperature rise at specified current.	EIA-364-70, Method 1. Stabilize at a single current level until 3 readings at 5 minute intervals are within 1°C. See Figure 4.																								
<b>MECHANICAL</b>																										
Vibration, random.	No discontinuities of 1 microsecond or longer duration. See Note.	EIA-364-28, Test Condition V, Condition F. Subject mated specimens to 20.71 G's rms between 50 to 2000 Hz. Fifteen minutes in each of 3 mutually perpendicular planes. See Figure 5.																								
Mechanical shock.	No discontinuities of 1 microsecond or longer duration. See Note.	EIA-364-27, Method A. Subject mated specimens to 50 G's half-sine shock pulses of 11 milliseconds duration. Three shocks in each direction applied along 3 mutually perpendicular planes, 18 total shocks. See Figure 5.																								
Durability.	See Note.	EIA-364-9. Mate and unmate gold flash specimens for 100 cycles, and 30 µin gold specimens for 500 cycles at a maximum rate of 200 cycles per hour.																								
Mating force.	<table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th>Size</th> <th>Posn</th> <th>Without Ground Indents (N [lbf] maximum)</th> <th>With Ground Indents (N [lbf] maximum)</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>9</td> <td>12.5 [2.8]</td> <td>133.4 [30]</td> </tr> <tr> <td>2</td> <td>15</td> <td>20.9 [4.7]</td> <td>146.8 [33]</td> </tr> <tr> <td>3</td> <td>25</td> <td>34.7 [7.8]</td> <td>164.6 [37]</td> </tr> <tr> <td>4</td> <td>37</td> <td>51.6 [11.6]</td> <td>177.9 [40]</td> </tr> <tr> <td>5</td> <td>50</td> <td>69.4 [15.6]</td> <td>195.7 [44]</td> </tr> </tbody> </table>	Size	Posn	Without Ground Indents (N [lbf] maximum)	With Ground Indents (N [lbf] maximum)	1	9	12.5 [2.8]	133.4 [30]	2	15	20.9 [4.7]	146.8 [33]	3	25	34.7 [7.8]	164.6 [37]	4	37	51.6 [11.6]	177.9 [40]	5	50	69.4 [15.6]	195.7 [44]	EIA-364-13. Measure force necessary to mate specimens at a maximum rate of 25.4 mm [1 in] per minute.
Size	Posn	Without Ground Indents (N [lbf] maximum)	With Ground Indents (N [lbf] maximum)																							
1	9	12.5 [2.8]	133.4 [30]																							
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Unmating force.	<table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th>Size</th> <th>Posn</th> <th>Without Ground Indents (N [lbf] maximum)</th> <th>With Ground Indents (N [lbf] maximum)</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>9</td> <td>12.5 [2.8]</td> <td>133.4 [30]</td> </tr> <tr> <td>2</td> <td>15</td> <td>20.9 [4.7]</td> <td>146.8 [33]</td> </tr> <tr> <td>3</td> <td>25</td> <td>34.7 [7.8]</td> <td>164.6 [37]</td> </tr> <tr> <td>4</td> <td>37</td> <td>51.6 [11.6]</td> <td>177.9 [40]</td> </tr> <tr> <td>5</td> <td>50</td> <td>69.4 [15.6]</td> <td>195.7 [44]</td> </tr> </tbody> </table>	Size	Posn	Without Ground Indents (N [lbf] maximum)	With Ground Indents (N [lbf] maximum)	1	9	12.5 [2.8]	133.4 [30]	2	15	20.9 [4.7]	146.8 [33]	3	25	34.7 [7.8]	164.6 [37]	4	37	51.6 [11.6]	177.9 [40]	5	50	69.4 [15.6]	195.7 [44]	EIA-364-13. Measure force necessary to unmate specimens at a maximum rate of 25.4 mm [1 in] per minute.
Size	Posn	Without Ground Indents (N [lbf] maximum)	With Ground Indents (N [lbf] maximum)																							
1	9	12.5 [2.8]	133.4 [30]																							
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5	50	69.4 [15.6]	195.7 [44]																							
Contact insertion force.	13.3 N [3 lbf] maximum per contact.	EIA-364-5. Measure force necessary to insert contact into housing.																								

Figure 1 (continued)

Test Description	Requirement	Procedure														
Contact retention force.	Contacts shall not dislodge from housing when subjected to a minimum force of 44.5 N [10 lbf].	EIA-364-29. Apply specified to contacts in an axial direction and hold for 6 seconds.														
Contact engaging force.	2.2 N [8 ozf] maximum per contact.	EIA-364-37. Measure force necessary to insert gage A to a depth of 5.6 mm [.220 in]. See Figure 6.														
Contact separating force.	0.208 N [.75 ozf] minimum per contact.	EIA-364-37. Size 2 times using gage A. Insert gage B to a depth of 5.6 mm [.220 in] and measure force necessary to separate gage B. See Figure 6.														
Crimp tensile.	<table border="1"> <thead> <tr> <th>Wire Size (AWG)</th> <th>Crimp Tensile (N [lbf] minimum)</th> </tr> </thead> <tbody> <tr> <td>18</td> <td>120.1 [27]</td> </tr> <tr> <td>20</td> <td>89 [20]</td> </tr> <tr> <td>22</td> <td>53.4 [12]</td> </tr> <tr> <td>24</td> <td>35.6 [8]</td> </tr> <tr> <td>26</td> <td>20 [4.5]</td> </tr> <tr> <td>28</td> <td>12 [2.7]</td> </tr> </tbody> </table>	Wire Size (AWG)	Crimp Tensile (N [lbf] minimum)	18	120.1 [27]	20	89 [20]	22	53.4 [12]	24	35.6 [8]	26	20 [4.5]	28	12 [2.7]	EIA-364-8. Determine crimp tensile at a maximum rate of 25.4 mm [1 in] per minute.
Wire Size (AWG)	Crimp Tensile (N [lbf] minimum)															
18	120.1 [27]															
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24	35.6 [8]															
26	20 [4.5]															
28	12 [2.7]															
<b>ENVIRONMENTAL</b>																
Thermal shock.	See Note.	EIA-364-32, Test Condition VII. Subject unmated specimens to 5 cycles between -55 and 105°C.														
Humidity/temperature cycling.	See Note.	EIA-364-31, Method III with cold shock. Subject mated specimens to 10 cycles (10 days) between 25 and 65°C at 80 to 100% RH.														
Temperature life.	See Note.	EIA-364-17, Method A, Test Condition 4, Test Time Condition C. Subject mated specimens to 105°C for 500 hours.														
Mixed flowing gas.	See Note.	EIA-364-65, Class IIIA (4 gas). Subject mated specimens to environmental Class IIIA for 20 days.														

**NOTE**

Shall meet visual requirements, show no physical damage, and meet requirements of additional tests as specified in the Product Qualification and Requalification Test Sequence shown in Figure 2.

Figure 1 (end)

3.6. Product Qualification and Requalification Test Sequence

Test or Examination	Test Group (a)				
	1	2	3	4	5
	Test Sequence (b)				
Initial examination of product	1	1	1	1	1
Low level contact resistance	3,7	2,8			
Contact resistance, specified current	8				
Insulation resistance			3,7		
Withstanding voltage			4,8		
Temperature rise vs current		3,9			
Vibration, random	5	7(c)			
Mechanical shock	6				
Durability	4	4			4
Mating force	2				2,5
Unmating force	9				3,6
Contact insertion force			2		
Contact retention force			9		
Contact engaging force				2	
Contact separating force				3	
Crimp tensile				4	
Thermal shock			5		
Humidity/temperature cycling			6		
Temperature life		6			
Mixed flowing gas		5			
Final examination of product	10	10	10	5	1,7

- NOTE**
- (a) See paragraph 4.1.A.
  - (b) Numbers indicate sequence in which tests are performed.
  - (c) Discontinuities shall not be measured. Energize at 18°C level for 100% loadings per Quality Specification 102-950.

Figure 2

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#### 4. QUALITY ASSURANCE PROVISIONS

##### 4.1. Qualification Testing

###### A. Specimen Selection

Connector housings and contacts shall be prepared in accordance with applicable Instruction Sheets and selected at random from current production. Test groups shall consist of the following:

1. Test Groups 1 and 3 shall consist of 10, size 1 (9 position) crimp-snap connector mated pairs (plugs without grounding indents), fully loaded with crimp-snap contacts with insulation support and crimped to 24 AWG wire. Group 1 uses gold flash and 30 gold contacts. Group 3 uses only gold flash contacts. Cable clamps are to be used on all connectors. During vibration and physical shock tests, screwlocks and male screws are to be used to secure the connectors.
2. Test Group 2 shall consist of 15 mated pairs, size 5 (50 position) crimp-snap connectors. Five mated pairs are loaded with 18 AWG wires, 5 with 24 AWG wire and 5 with 28 AWG wire. The plugs have no grounding indents, and the wires are crimped to contacts without insulation support. The contacts are gold flash plated. Cable clamps are to be used on all connectors.
3. Test Group 4 shall consist of 30 each of contacts with insulation support crimped to 24, 26, and 28 AWG wire. The 18, 20 and 22 AWG wires are crimped to contacts without insulation support. The contacts are gold flash plated.
4. Test Group 5 shall consist of 5 of each size of mated pairs fully loaded with contacts. The plugs have grounding indents. The contacts are gold flash plated.

###### B. Test Sequence

Qualification inspection shall be verified by testing specimens as specified in Figure 2.

##### 4.2. Requalification Testing

If changes significantly affecting form, fit or function are made to the product or manufacturing process, product assurance shall coordinate requalification testing, consisting of all or part of the original testing sequence as determined by development/product, quality and reliability engineering.

##### 4.3. Acceptance

Acceptance is based on verification that the product meets the requirements of Figure 1. Failures attributed to equipment, test setup or operator deficiencies shall not disqualify the product. If product failure occurs, corrective action shall be taken and specimens resubmitted for qualification. Testing to confirm corrective action is required before resubmittal.

##### 4.4. Quality Conformance Inspection

The applicable quality inspection plan shall specify the sampling acceptable quality level to be used. Dimensional and functional requirements shall be in accordance with the applicable product drawing and this specification.

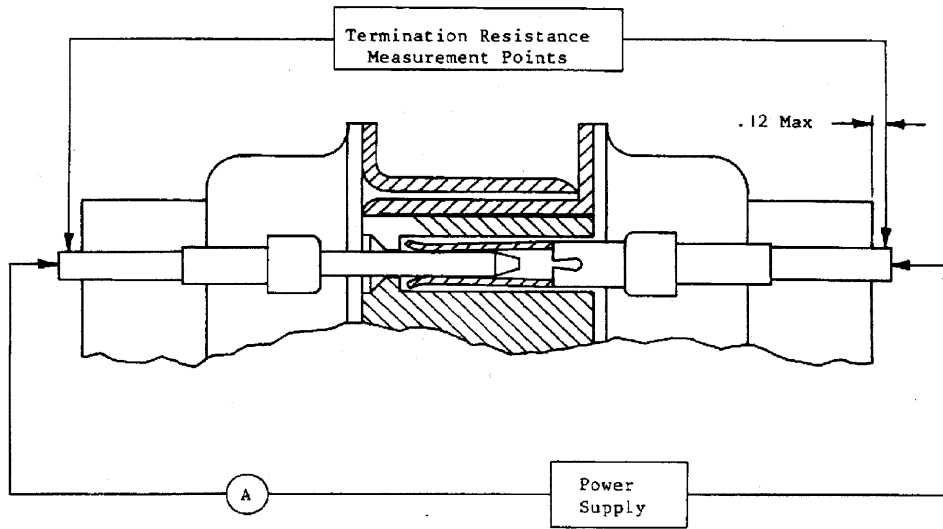


Figure 3  
Low Level Contact Resistance Measurement Points

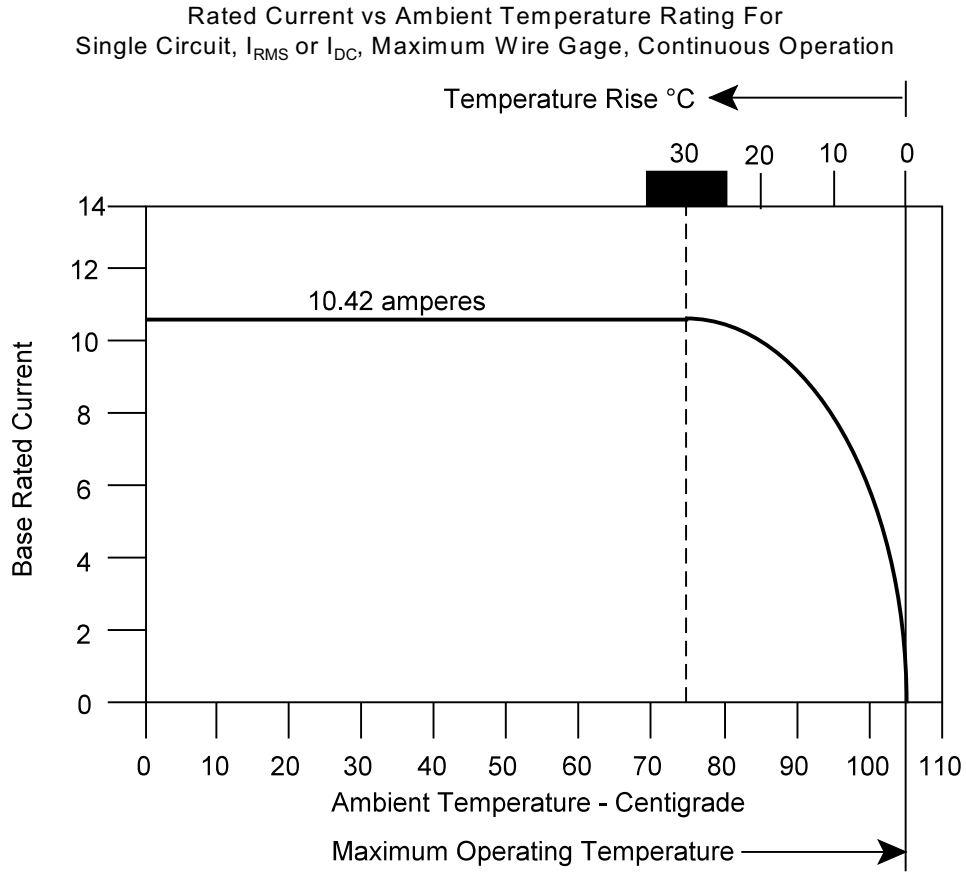


Figure 4A  
Current Carrying Capability

Percent Connector Loading	Wire Size AWG					
	28	26	24	22	20	18
Single contact	.384	.450	.536	.647	.795	1
26	.237	.278	.342	.400	.491	.618
50	.164	.193	.229	.277	.341	.428
76	.132	.155	.184	.222	.273	.344
100	.114	.134	.159	.192	.236	.297

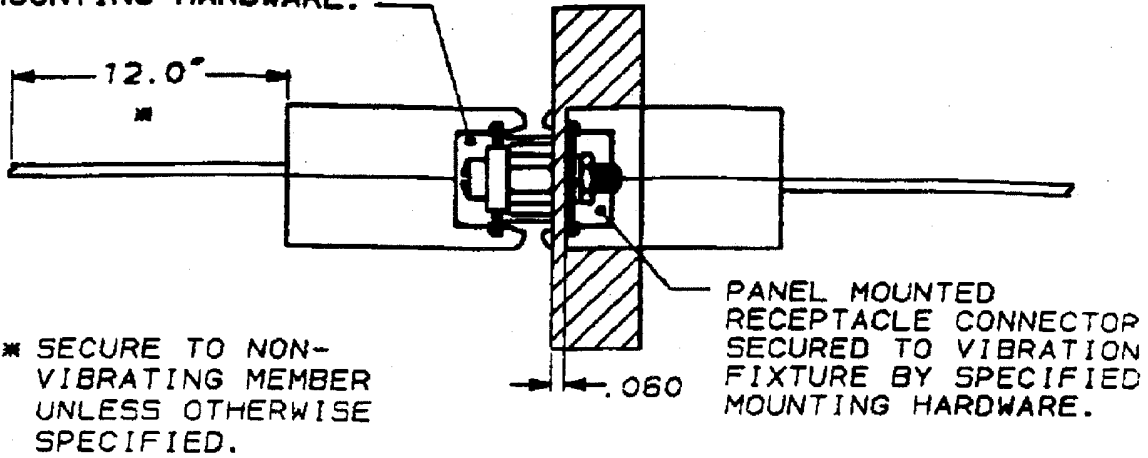
**NOTE**

To determine acceptable current carrying capacity **per contact** for percentage connector loading and wire gage indicated, use the Multiplication Factor (F) from the above chart and multiply it times the Base rated Current for a single circuit at the maximum ambient operating temperature shown in Figure 4A.

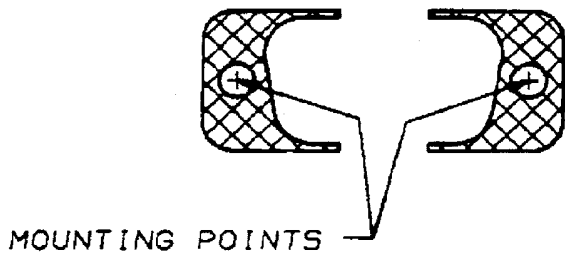
Figure 4B  
Current Rating



PLUG CONNECTOR FULLY MATED AND FASTENED TO MATING CONNECTOR BY SPECIFIED MOUNTING HARDWARE.



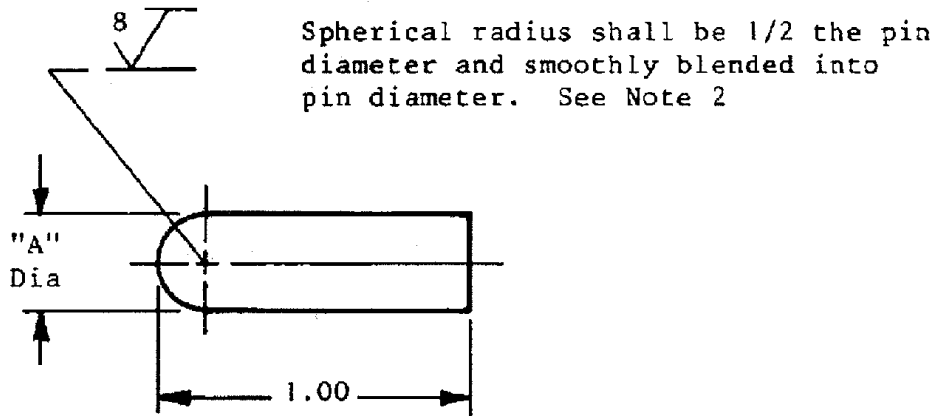
NOTE: RECEPTACLE CONNECTOR TO BE MOUNTED ON VIBRATION FIXTURE UNLESS OTHERWISE SPECIFIED.



SHELL SIZE	FIXTURE NUMBER
1	
2	
3	458165
4	
5	458166

VIBRATION LEVEL IS APPLIED TO THE SPECIFIED CONNECTOR MOUNTING AREA (XXXX) OF THE VIBRATION FIXTURE.

Figure 5  
Vibration and Mechanical Shock Mounting Fixture



Gage	Part Number	"A" Diameter
A	92-944011-1	.0410 +.0000/-0.0001
B	92-944011-2	.0390 +.0001/-0000

**NOTE**

1. Gage Material: High speed steel lapped finish to 1 microinch.
2. Do not change size or finish of "A" Diameter where spherical radius blends.
3. Heat Treat to RC 62-64.
4. This gage is for contact size 20.

Figure 6