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Research Testing of Commercial Retractable Handles for Small Containers

AFMC LSO/LOP
AIR FORCE PACKAGING TECHNOLOGY AND ENGINEERING FACILITY
WRIGHT PATTERSON AFB, OH 45433-5540
January 1996
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PROJECT NO. 93-P-107
TITLE: Research & Testing of Commercial Handles for Small Containers

ABSTRACT

This project was established to identify handle manufactures and their products with some type of handle strength rating. Currently AFPTEF is using aluminum rod bent into a handle shape. The handle is held in place with a cotter pin and aluminum blocks welded to the container wall. This design was developed at AFPTEF to fulfill users need for field repairable handles.

AFPTEF’s handles met the users need, however, the handles are not retractable, i.e. spring loaded, and would swing out from the container wall during drop testing. On small containers experiencing free fall drop testing, the handles would get damaged between the container and the ground. The damage was sporadic, therefore, AFPTEF wanted to look at the retractable handles that would hold the handle up against the container wall. The AFPTEF’s goal was to test the commercial handles and certify them to a rated load and eliminate the need to repeat testing of handles on other containers.

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Ch, Design Branch
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# TABLE OF CONTENTS

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Abstract</td>
<td>i</td>
</tr>
<tr>
<td>Table of Contents</td>
<td>ii</td>
</tr>
<tr>
<td>Introduction</td>
<td>1</td>
</tr>
<tr>
<td>Test Procedure</td>
<td>1</td>
</tr>
<tr>
<td>Results</td>
<td>2</td>
</tr>
<tr>
<td>Conclusion</td>
<td>3</td>
</tr>
<tr>
<td>Recommendations</td>
<td>4</td>
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## APPENDICES

<table>
<thead>
<tr>
<th>Appendix</th>
<th>Title</th>
<th>Page</th>
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<tbody>
<tr>
<td>Appendix 1</td>
<td>Test Plan</td>
<td>5</td>
</tr>
<tr>
<td>Appendix 2</td>
<td>Test Results</td>
<td>7</td>
</tr>
<tr>
<td>Appendix 3</td>
<td>Photographs</td>
<td>9</td>
</tr>
<tr>
<td>Appendix 4</td>
<td>Distribution List</td>
<td>15</td>
</tr>
<tr>
<td>Appendix 5</td>
<td>Report Documentation</td>
<td>22</td>
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</table>
RESEARCH TESTING OF COMMERCIAL RETRACTABLE HANDLES FOR SMALL CONTAINERS

INTRODUCTION:

This project was established to identify handle manufacturers, their products, and establish a handle strength rating. Currently AFPTEF is using aluminum rod bent into a handle shape. The handle is held in place with a cotter pin and aluminum blocks welded to the container wall. This design was developed at AFPTEF to fulfill users need for field repairable handles.

AFPTEF's handles met the users need, however, the handles were not retractable, i.e. spring loaded, and would swing out during drop testing. On small containers experiencing free fall drop testing, the handles would get damaged between the container and ground. The damage was sporadic, therefore, AFPTEF wanted to look at retractable handles that would hold the handle up against the container wall.

AFPTEF's goals were:

- To establish a standard test for commercially manufactured handles.
- To establish a rating system for the handles with handle manufactures and part numbers identified.
- To eliminate repetitive testing of the same handle over again and be able to reference this project to verify handle performance.

TEST PROCEDURE:

The handles are attached to a container wall with four rivets. The handle is rotated until it comes in contact with a physical stop. The angle of the handle is then measured with respect to the container wall. This angle is call the rotation angle and is to be measured and recorded prior to testing. The handle is then pulled from side to side to measure any lateral movement the handle may have. The measurement is taken from the edge of the plate to the inside of the bail. The lateral movement is recorded.

The container is secured to the floor and the handles are pulled in four different directions using a hydraulic tensile tester, see Figure 1. The four directions are described in the test plan, Attachment 1. The pulling force starts at 50 Kg ± 2 Kg and increase in increments of 10 Kg ± 2 Kg. At each 10 Kg increase, the handle is visually inspected and measured for bending and/or
pulling away from the container. The force is held for a minimum of 1 minute.

At 120 Kg and each 10 Kg interval after, the force is removed and the handle is observed for permanent deformation and performance. The force at which one starts removing the force for a closer inspection may vary depending on the handle being tested. When permanent deformation occurs, testing is completed.

RESULTS:

The handles were manufactured by Nielson Hardware and made of stainless steel, i.e. the bail, plate, and spring. The part number for the handle is H945-3500SS2RG75SS-01. The bail size is 127 mm X 77 mm. The handle had a 94° rotation at the physical stop and 10 mm lateral movement in each direction. The part number of the rivet is CR3213-5-4. See Table I for test results.

During Test A visual inspections were made with the applied force removed. The applied force and comments of the visual inspection are below:

- 80 Kg, the handle functioned normally with an increase rotation up to 105°.
- 100 Kg, the handle functioned normally with an increase rotation up to 112°. The physical stop started to show slight deformation, see Figure 2.
- 130 Kg, the handle functioned normally with a rotation of 112°.
- 160 Kg, the handle functioned normally. The bail flexed past the physical stop. This changed the angle the applied force was pulling.
- 200 Kg, the handle functioned normally.
- 220 Kg, the handle is starting to show signs of deformation. The spring action is a little hampered.
- 250 Kg, the handle came in contact with the container when the load was applied, see Figure 3. The spring action failed to return the bail completely back against the container wall.

During Test B visual inspections were made with the applied force removed. The applied force and comments of the visual inspection are below:

- 150 Kg, the handle functioned normally.
- 170 Kg, the handle functioned normally. When load applied, the bail flexed 5 mm.
• 200 Kg, the handle functioned normally. When load applied, the bail flexed 10 mm.

• 250 Kg, the handle functioned normally. When load applied, the bail flexed 10 mm. The force was increased.

• 350 Kg, the handle functioned normally. The spring action is slightly hesitant, but retracts the bail completely.

• 400 Kg, the handle functioned normally. Spring action still hesitant. When load applied, the bail flexed 15 mm.

• 420 Kg, the handle functioned normally. Spring action hesitation is increasing. Bail starting to show signs of deformation, see Figure 4.

• 430 Kg, spring action more hesitant and not completely returning bail to container wall. Bail deformed.

• 460 Kg, spring action failed to return the bail to the container wall. Bail deformed 25 mm.

During Test C1 visual inspections were made with the applied force removed. The applied force and comments of the visual inspection are below:

• 120 Kg, spring action hesitant. Bail starting to show signs of deformation, see Figure 5.

• 140 Kg, spring action failed. Bail deformed, see Figure 6.

During Test C2 visual inspections were made with the applied force removed. The applied force and comments of the visual inspection are below:

• 120 Kg, the handle functioned normally.

• 150 Kg, bail showing signs of deformation, see Figure 7. Spring action is normal.

• 170 Kg, spring action hesitant. Bail deformed, see Figure 8.

• 180 Kg, spring action more hesitant.

• 200 Kg, spring action failed.

CONCLUSION:

The handles performed well. The handles were removed from the container and inspected. The cause of the spring failure for Tests C1 & C2 was determined to be the bail pulled out beyond the spring. This allowed the tension in the spring to be released. In Tests A & B the cause of the spring failure was determined to
be the bail being bent in the area where the spring wrapped around the bail. This caused friction between the bail and spring and didn't allow the spring to retract the bail.

RECOMMENDATIONS:

From the results in Tests A & B only, which is consider the working directions of the handle, the handle could be rated at a maximum load of 220 Kg, however, fatigue factor is not accounted for in this test. Therefore, the work load for the handle should be a certain percentage from the maximum load.

From the results in Tests C1 & C2 only, the handle could be rated at a maximum of 120 Kg. Again, the working load should be a percentage of the maximum load, however, this percentage can be lower than the percentage used to determine the load for the working direction. This test was design to simulate the possibility of the handle being used as a tie down point. The direction that was pulled is considered a worst case scenario.
APPENDIX 1

TEST PLAN
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<td><strong>HANDLE HOISTING/PULL TEST</strong></td>
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<td>At the center of a handle, apply a force of 200 kg in the upward direction, parallel to the container side.</td>
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<td>Part C</td>
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<tr>
<td>b.</td>
<td>(4.7.4) Modified</td>
<td>At the center of a handle, apply a force of 200 Kg in the direction perpendicular to the container side.</td>
<td>VI</td>
<td></td>
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<td>c.</td>
<td>(4.7.4) Modified</td>
<td>At the center, on the side of the handle, apply a force of 180 Kg in the direction parallel to the container side. Both directions.</td>
<td>VI</td>
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**COMMENTS:**
* Figures in parenthesis () refer to paragraphs in MIL-C-5584D.
APPENDIX 2

TEST RESULTS
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APPENDIX 3

PHOTOGRAPHS
Figure 1. TEST SETUP.

Figure 2. PHYSICAL STOP DEFORMATION.
Figure 3. 250 Kg LOAD APPLIED.
Figure 4. BAIL DEFORMATION.

Figure 5. BAIL SHOWING SIGNS OF DEFORMATION.
Figure 6. BAIL DEFORMATION.

Figure 7. BAIL SHOWING SIGNS OF DEFORMATION.
Figure 8. BAIL DEFORMATION.
APPENDIX 4

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COMMANDER

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NAVAL SUPPLY SYSTEMS COMMAND
1931 JEFFERSON DAVIS HWY
ARLINGTON VA 22241-5360

COMMANDER
ATTN: E PANIGOT (AIR 41212A)
NAVAL AIR SYSTEMS COMMAND
WASHINGTON DC 20361

COMMANDER
NAVAL SEA SYSTEMS COMMAND
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WASHINGTON DC 20362

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FT LEE VA 23801-6034

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DOVER NJ 07801-5001

AFMC LSO/LOE
WRIGHT-PATTERSON AFB OH 45433

ATTN: DLA-MMDO
DEFENSE LOGISTICS AGENCY
CAMERON STATION
ALEXANDRIA VA 22304-6100

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DAVIS MONTANT AFB AZ 85707-4341

HQ PACAF/LGT BLDG 1102
25 E. ST. STE 1326
HICKAM AFB HI 96853-5426

HQ USAF/LGT
UNIT 3050 BOX 105
APO AE 09094-0105

HQ ACC/LGT
130 DOUGLAS ST STE 210
LANGLEY AFB VA 23665-2791

HQ AF SPACECOM/LGT
150 VANDENBURG ST., STE 1105
PETERSON AFB CO 80914-5000

HQ AETC/LGT
555 E ST EAST
RANDOLPH AFB TX 78150-4440

*HQ AFSA/SEW
ATTN: ARLIE ADAMS
9700 AVENUE G STE 263
KIRTLAND AFB NM 87117-5670


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DISTRIBUTION LIST (Cont'd)

*COMMANDER, US ARMY ARMAMENT RESEARCH DEVELOPMENT AND ENGINEERING CENTER
SMCAR-ESK
ATTN: DAVE PISKORIK
ROCK ISLAND IL 61299-7300
APPENDIX 5

REPORT DOCUMENTATION
This project was established to identify handle manufacturers and their products with some type of handle strength rating. Current handles are not retractable, i.e. spring loaded, and would swing out from the container wall during drop testing. On small containers experiencing free fall drop testing, the handles would get damaged between the container and the ground. The damage was sporadic, therefore, AFPTEF wanted to look at the retractable handles that would hold the handle up against the container wall. The AFPTEF's goal was to test the commercial handles and certify them to a rated load and eliminate the need to repeat testing of handles on other containers.