Preface

The SEFA Desk Reference is dedicated to all the SEFA members who actively participate in the various Recommended Practice Committees. This book is the culmination of their hard work spanning thousands of hours of collective time over two decades. SEFA develops these Recommended Practices to create a greater awareness of the difference between “Laboratory Grade” furniture, products and accessories, and what is commonly used in other environments. SEFA’s Recommended Practices serve as a benchmark for “Laboratory Grade” furniture throughout the world and insure the design and construction of the safest laboratory facilities.

These Recommended Practices are constantly being updated based on member comments as well as feedback from the lab planners, architects, engineers, manufacturers, contractors, dealers, installers and ultimately the scientists who use SEFA member furniture, fume hoods and related laboratory products and accessories. If you have any questions or comments, please email us at info@sefalabs.com.

David J. Sutton, CAE, JD
Executive Director and General Counsel

March, 2016
# Table of Contents

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>2015-2016 Board of Directors</td>
<td>6</td>
</tr>
<tr>
<td>SEFA Member Directory</td>
<td>7</td>
</tr>
<tr>
<td>Advisory Board Members</td>
<td>19</td>
</tr>
<tr>
<td>Past Chairmen</td>
<td>20</td>
</tr>
<tr>
<td>By-Laws</td>
<td>21</td>
</tr>
<tr>
<td>SEFA-Approved Test Labs</td>
<td>34</td>
</tr>
<tr>
<td>Code of Ethics</td>
<td>35</td>
</tr>
</tbody>
</table>

## Recommended Practices

<table>
<thead>
<tr>
<th>SEFA</th>
<th>Title</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-2010</td>
<td>- Fume Hoods</td>
<td>45</td>
</tr>
<tr>
<td>2-2010</td>
<td>- Installation</td>
<td>101</td>
</tr>
<tr>
<td>3-2010</td>
<td>- Work Surfaces</td>
<td>115</td>
</tr>
<tr>
<td>4-2010</td>
<td>- Glossary of Terms</td>
<td>125</td>
</tr>
<tr>
<td>5-2010</td>
<td>- Scope of Work</td>
<td>139</td>
</tr>
<tr>
<td>7-2010</td>
<td>- Fixtures</td>
<td>153</td>
</tr>
<tr>
<td>8-M-2016</td>
<td>- Laboratory Grade Metal Casework</td>
<td>177</td>
</tr>
<tr>
<td>8-PH-2014</td>
<td>Laboratory Grade Phenolic Casework</td>
<td>201</td>
</tr>
<tr>
<td>8-PL-2016</td>
<td>Laboratory Grade Plastic Laminate Casework</td>
<td>221</td>
</tr>
<tr>
<td>8-P-2014</td>
<td>- Laboratory Grade Polypropylene Casework</td>
<td>245</td>
</tr>
<tr>
<td>8-W-2016</td>
<td>- Laboratory Grade Wood Casework</td>
<td>271</td>
</tr>
<tr>
<td>9-2010</td>
<td>- Ductless Enclosures</td>
<td>293</td>
</tr>
<tr>
<td>10-2013</td>
<td>- Adaptable Casework Systems</td>
<td>309</td>
</tr>
<tr>
<td>11-2010</td>
<td>- Liquid Chemical Storage</td>
<td>349</td>
</tr>
</tbody>
</table>

**ADVERTISERS** 361
SEFA’s Board of Directors

2016/2017

Chairman

Eddie Adkins  Sheldon Labs

Vice Chairman

Mario DiFonte  Mott Manufacturing

Secretary / Treasurer

Kurt Rindoks  Kewaunee Scientific

Immediate Past Chair

Tom Schwaller  Labconco Corporation

At Large Directors

Frank Conner  TFI Inline Design Corp.
Robert Deluca Jr.  Lab Crafters, Inc.
Lloyd Fisk  Research Facilities Design
Jorge Santos  Flores Valles
Ingo Sternitzke  Trespa B.V.
SEFA Member Directory  
(4/15/2017)

**A & S Technology, Ltd., (E)**  
Unit 3012 Eight Commercial Tower  
8 Sun Yip Street, Chaiwan, Hong Kong  
Tel: 852-2898-8020 - Fax: 852-2898-9076  
Tim Chan - tim@astech.com.hk  
Chris Ho - chris@astech.com.hk

**A.T. Villa, Inc. (E)**  
1233 North Mayfair Road—Ste 302  
Milwaukee, WI  53226  
Tel: 800-554-9259 - Fax: 978-582-7488  
Derek Matson - derek.matson@atvilla.com  
Ken Callahan - Ken.Callahan@atvilla.com

**Aakar Scientific Pvt., Ltd., (E)**  
443 GIDC Estate, Makarpura  
Vadodara, Gujarat 390 010 INDIA  
Tel: 86-519-88500208—Fax 86-519-88500728  
Makarand Musale - aspl@aakarscientific.com  
exports@aakarscientific.com

**abell nepp (AB)**  
74 Margaret Street  
London W1W 8SU UK  
Tel: +44 20 7612 1583  
Bruce Nepp, Director - bruce@abell-nepp.co.uk

**Abu Dhabi Medical Industries, LLC (E)**  
M-43 Plot No. 125,126  
Abu Dhabi, Mussafah  UAE 52115  
Tel: 971 2 5513422 —Fax 971 2 5513423  
Krishnalal admin.amii@amilab.ae

**Acier Inoxy-Lab, Inc. (E)**  
2574 Avenue Dalton  
Quebec G1P354 CANADA  
Tel: 418 657 5020 —Fax 418 657 7081  
A. Labbe -amelie.labbe@acierinoxy-lab.com

**AirClean Systems (E)**  
2179 East Lyon Station Road  
Creedmoor, NC 27522  
Tel: 919-255-3220—Fax: 919-255-6120  
Kevin McGough - Pres.  
Kevin@aircleansystems.com  
Hayden Marshburn - Asst Marketing Mgr.  
hayden@aircleansystems.com

**Air Control, Inc. (E)**  
Harbor Place—7 Rantoul St., 205  
Beverly, MA 01915  
Tel: 978 524 8906 -Fax: 978 524 8916  
Kenneth Dixon, CEO - kdixon@aircontrol-inc.com

**Air Master Systems (E)**  
6480 Norton Center Drive  
Muskegon, MI  49441  
Tel: 231-798-1111 -Fax: 231-4000  
Don Nelson, Pres. don@airmastersystems.com  
Jim Smith - jim@airmastersystems.com

**Art Lab Equipments (E)**  
Plot No. 5L, Phase V, Ida-Jeedimetla  
Hyderabad, Telangana 500 055 India  
Tel: +919849010014 -Fax: +91 40-40063678  
Suresh Kumar, Director - artlabsindia@gmail.com  
Anil Kumar - anil@artlabsindia.com

**asecos, GmbH (E)**  
Weiherfeldsiedlung 16-18  
Gruendau-Lieblos, GERMANY 63584  
Tel: +49 6051 9220-0 - Fax: +49 6051 9220-10  
Sascha Kunkel, Global Sales Mgr. info@asecos.com

**Ayers Saint Gross Architects (A)**  
1040 Hull Street - Ste 100  
Baltimore, MD  21230  
Tel: 410.347.8500—Fax: 410.347.8519  
Michael Salsbury - msalsbury@asg-architects.com  
Ed Kohls - ekohls@asg-architects.com

**Becomar De Mexico S. De R.L. De C.V. (E)**  
Emiliano Zapata #103 Col. San Blas Otzacatipan  
Toluca, Mexico 50220  
Tel: 52- 722 237-1220 Fax: 52- 722 237-1220  
Marco Rodriguez - International Manager  
mrodriguez@becomardegmexico.com

**Bedcolab, Ltd. (E)**  
2305 Francis Hughes Ave.  
Laval, Quebec H7S 1N5 Canada  
Tel: 514 384 2820 Fax: 514 384 9292  
Ronald Bedard, Pres. - ronbedard@bedcolab.com  
Pierre Poirier, Sales Dir. - ppoirier@bedcolab.com

* (E) Executive Member  
(AB) Advisory Board

(A) Associate Member 
(S) Sustaining Member

© SEFA - 5th Edition Desk Reference - Version 2.0  
Page 7
SEFA Member Directory
(4/15/2017)

Beijing Aerospace Keen Laboratory Equipment Eng. Technology Co., Ltd. (E)
8A07 Changyi Bldg., Block A, No. 88 Younglin Rd Haidian District, Beijing 100039 CHINA
Tel: 86-139-1005 4711- Fax: 86-010-5889 6144
Fan Jun, General Mgr—bjhtke@126.com

Beijing Chengwei Borui Lab & Equipment Co., Ltd. (E)
No. 66 Guoan Chuangke Tian Xi Di yi Cheng Langfang Xianghe Hebei 065400 CHINA
Tel: 86-133-31150877- Fax: 86-010-62145537
Ziyi Zhou, General Mgr—zhou8521@188.com
Jiarui Wang - cw1333118010@126.com

Beijing Guoma Surf Lab & Equip Co. (E)
4th Fl., BoYa Bldg. CC#4, Yiliaoyuan Road Zhongguancun Life Sci Park, Beijing 102206 China
Tel: 86-10-56545212- Fax: 86-10-56545209
William Xu—international@surflab-bj.com

Beijing Hanguang Chengwei Lab Equipment Eng. Tech Co., Ltd. (S)
Room 3103, A Bldg GuoRun Commercial Plaza No. 46 West 4th Circle South Road Feng Tai District, Beijing 100071 China
Tel: 86-10-83650691 - Fax: 86-10-83650692
Kebin Wang - wangkb588@163.com

Beijing Mingyuan Weiye Lab Equip. (E)
Industrial Park Qiliqu Shahe Zhen, Beijing 102206 China
Tel: 86-10-80708861- Fax: 86-10-80719534
Dong Qing Liu Gen’l Mgr. allan-liu@126.com
Susan Qin—bjhsld@126.com

Beijing Sen La Poole Laboratory Technology Co., Ltd. (S)
Room 710, Unit 1, Bldg No. 3 Pearl River Moer Bldg, Beijing Road No. 1 Chang Ping District, Beijing 102206 CHINA
Tel: 86-010-69739621 - Fax: 86-010-69739621
Chen Yuan - chenyuan@slplab.com

Beijing Shine Science & Tech Co. (S)
Fengtai Dist., Chengnan Avenue, Block 1 Rm 1109 Beijing 100068 China
Tel: 86-1083504060 - Fax: 86-1083502416-239
Jinfeng Pan - pan_jingfeng@qq.com

Beijing Sun Lab Equipment Co. (E)
Room 2008, Tianxingjian Bldg. No. 47 Fuxing Road, Haidian Dist 5, Beijing 100036 China
Tel: 86-010-51921601 - Fax: 86-21-642-72085
Catherine Wu—Asst to Chairman wujingmiss@126.com - sunlab@163.com

Beijing Xingao Lab Equip. Co. (E)
Bldg 71 No. 15 Central Branch Road Jinqiao Science & Technology Industry Base Zhongguancun Science Park, Tongzhou Park Beijing 101102 China
Tel: 86-139-10118293 - Fax: 86-010-61283150
Xiaoying Liu—beijingxingao@126.com

Beijing ZHILAB Lab Equipment (S)
Rm 1501, No. 5 Bldg 15 Hongjunying Rd South, Chaoyang District, Beijing 100012 China
Tel: 86-10-84829626 - Fax: 86-10-84829629
Yaping Liu—ypliu@zhilab.com

Beryl Laboratory Eng. Co., Ltd. (S)
4F, Bldgs 6, No. 797 Puxing Road, Minhang District Shanghai 201112 China
Tel: 86-21-61636318 - Fax: 86-21-61636313
Andy Geng, Pres. - andy.geng@berylab.com

Bicasa S.R.L. (E)
Viale delle Industrie, 33
20881 Bernareggio (MB) Italy
Tel: +39.039.60291 Fax: +39.039.6093153
Dr. Ken Kann—Ken kesavan@bicasa.ae
Dr. Fabio Biffi—fabio.biffi@bicasa.it

Brewer Construction Services, LLC., (A)
1207 Price Plaza Drive, Katy, TX 77449
Tel.: 713.899.8972 Fax: 281.769.5514
Dennis Brewer, Pres. dennis.brewer@brewercs.com

* (E) Executive Member   (S) Sustaining Member   (A) Associate Member   (AB) Advisory Board
SEFA Member Directory
(4/15/2017)

BROEN-LAB A/S (E)
Drejervænget 2- DK-5610 Assens, Denmark
Tel.: +45 6471 2095 • Fax: +45 6471 2476
Jesper Torp, CEO - jto@broen-lab.com
Torben Jeppesen tfj@broen-lab.com

Burdinola, S. Coop. (E)
Carretera Lekeitio, km. 53,5 - C.P. /48289 Amoroto, Bizkaia 48289 SPAIN
Tel.: +34 946 840 766 • Fax: +34 946 842 005
Ana de la Riva adelaivar@burdinola.com
Juan M. Lopez Redondo jmlopez@burdinola.com

C & C Scientific (S) Pte. Ltd. (E)
No. 5, Yishun Industrial Street 1, #07-07, Northspring Bizhub, Singapore 768161
Tel: 65 68760030 • Fax: 65 68760200
Chin Hie Ho, Director- raymond@cncscientific.com
Miss Goh - accounts@cncscientific.com

CHC Lab (E)
139, Techno 2-ro 1
Yuseong-Gu, Daejeon, KOREA 305 500
Tel: 82-42-933-0036 • Fax: 82-42-933-0039
Myoung Hwan Oh, international@chclab.com

C.L. Andrews, LLC (A)
13843 E. Kalil Drive, Scottsdale, AZ 85259
Tel: 480.661.5590
Chris@clandrews.com

CIF Lab Casework Solutions, Inc. (E)
53 Courtland Avenue
Vaughan, Ontario, L4K3T2 Canada
Tel: 905 738 5821 • Fax: 905 738 6537
Vince Occhipinti VP- vocchipinti@cifsolutions.com
John Shultz VP Sales & Marketing - jshultz@cifsolutions.com

Cabinets by Design, Inc. (E)
2883 Pleasant Hill Road, Duluth, GA 30096
Tel: 770-418-1200 Fax: 770-418-1500
Fari Vakili, Pres - fvakili@cabinetsbydesigninc.com

Cannon Design (AB)
1100 Clark Avenue
St. Louis, MO 63102
Tel: 314-241-6250
Punit Jain, Vice Pres.- pjain@cannondesign.com

Case Systems, Inc. (E)
2700 James Savage Rd.
Midland, MI 48642
Tel: 989 496–046051 - Fax: 989 496 9925
Kevin Ward-Kevin.ward@casesystems.com

Citizen Industries (E)
57 GIDC Estate, Phase II
Naroda Industrial Estate
Ahmedabad, Gujarat INDIA 380009
Tel: +91 7 926445155 Fax: +91 79 26565642
Kamalesh Mehta - corporate@citizenindia.com

Covilla Technologies (S)
No. 333 Huaihai Middle Road,
Shui on Plaza 1206-A12, Huangpu District
Shanghai 200021 CHINA
Tel: +86 13917836182- Fax: +86 21-50133251
Eric Wong, Gen Mgr. - Eric.wong@covilla.com

Custom Diamond International (E)
895 Avenue Munck
Laval, Quebec CANADA H7S 1A9
Tel: 450-668-0330 Fax: 450-662-1326
Hilly Diamond VP Operations
hillydiamond@diamond-group.com
Gary Mintz - gmintz@diamond-group.com

Creative Solutions (A)
P.O. Box 90365, Nashville, TN 37209
Tel: 512-588-2002 Fax: 615-523-1240
Chip Albright - chip@chipalbright.com

Dalton Corporation (E)
Hamarikyu Parkside Place, 5-6-1Tsukiji
Chuo-ku, Tokyo 104-0045 JAPAN
Tel: 81-3-35496810 Fax 81-3-35496851
Shinji Sunohara, Director s-sunohara@dalton.co.jp
Mr. Tatsuya Kobayashi t-kobayashi@dalton.co.jp

* (E) Executive Member    (S) Sustaining Member    (A) Associate Member    (AB) Advisory Board
SEFA Member Directory
(4/15/2017)

Daxpro Suzhou Lab Sys. Eng. Co., Ltd. (E)
No. 58 Chang'An Road, Pu Zhuang Ind. Park
Wuzhong District, Suzhou 215106 China
Tel: +86-1801-3576283 Fax: +86-0512-66583188
Wang Fengzhu—wangfengzhu@daxpro.com.cn

Design Alternative Co., Ltd. (E)
480 Moo3, Soi Pracha Uthit 90, Pracha Uthit Road
Banklongsuan, Prasamutchedeep
Samutprakarn 10290 Thailand
Tel: +66-0-02848488 Fax: +66-0-2848 4882
Somchjai Rungtiravatananon - Director
dac@design-alternative.com

Diversified Woodcrafts, Inc. (E)
300 S. Krueger St.
Suring, WI 54174
Tel: 920-842-2136 - Fax: 920 842 2499
David Jahnke, Pres—djahnke@divwood.com
Brant Kelly 336-329-9682 - bkelly@divwood.com

Durcon (E)
206 Allison Drive
Taylor, TX  76574
Tel: 512-595-8000 - Fax 512-595-8400
Kent Cook - kcook@durcon.com
Hank Von der Bruegge, VP — HankV@durcon.com

ECT, Inc. (A)
231-C East Johnson Street
Cary, NC 27513
Tel: 919-319-4290 - Fax: 919-319-4291
Tom Smith, Pres tsmith@labhoodpro.com

ERP Hychem SDN BHD (E)
No. 8018 KG Bukit Cherakah, Shah Alam
Selangor, Malaysia 40150
Tel: +60.12.644.1212 - Fax: +60.3.7846.7633
Nick Ng, Gen’l Mgr nick@hychem.com.my
Raja Zarina zarina@hychem.com.my

Eagle MHC (E)
100 Industrial Boulevard
Clayton, DE 19938
Tel: 302-207-6592 - Fax: 302-653-2065
Paul Northam, Nat’l Accts -eagle46@airmail.net
Leslie Atherholt - latherholt@eaglegrp.com

* (E) Executive Member    (S) Sustaining Member
(E) Executive Member       (S) Sustaining Member

ECHO Research & Develop. S.p.A. (E)
Via Dell’Innovazione 9
Cormano (MI) Lombardia 20032 Italy
Tel: 39 02 66306709 Fax: 39 02 66306714
Davide Ceriani, CEO d.ceriani@echord.it
Luca Cabiale l.cabiale@echord.it

EGNATON (A)
Muhltalstr. 61
D-64625 Bensheim
Tel: ++49 6251-704720 - Fax: ++49 6251-7047220
Egbert Dittrich, Managing Director
egbert.dittrich@egnaton.com

Fibersin Industries, Inc. (E)
P.O. Box 88, 37031 East Wisconsin Avenue
Oconomowoc, WI 53066
Tel: 262-567-4457 Fax: 262-567-4814
James Schwind—jschwind@fibersin.com
Mike MacDougal mmacdougal@fibersin.com

Flad & Associates (AB)
644 Science Drive—P.O. Box 44977
Madison, WI 53744
Tel: 608-238-2661 - Fax: 608 238 6727
TH Chang, Principal - tchang@flad.com

Flores Valles SA (E)
Calle Isla de Jamaica 10
Madrid 28034 SPAIN
Tel: 0034-917611094  Fax: 0034-917611097
Virginie Foucher vfoucher@floresvalles.com
Bruno Ricciardi -bricciardi@floresvalles.com

Flow Sciences, Inc. (E)
20 25 Mercantile Drive
Leland, NC 28451
Tel: 910-763-1717  Fax: 910-763-1220
Ray Ryan, Pres/CEO rryan@flowsciences.com
James R. Wind, CFO jwind@flowsciences.com

FunderMax GmbH (E)
Klagenfurter Strasse 87-89
St. Veit Iglan 9300 Austria
Tel: 0043.59494 4530
Arnulf Penker - arnulf.penker@fundermax.biz

(A) Associate Member    (AB) Advisory Board
<table>
<thead>
<tr>
<th><strong>FutureLabs, LLC (E)</strong></th>
<th><strong>Guangdong Beta Laboratory Furniture Co. Ltd. (E)</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>P.O. Box 33 PC 616 Birkat Al Mouz, Nizwa, Sultanate of Oman 616 Tel: 00968-25446627 Fax: 0096825446628 Santhosh Palliicken <a href="mailto:-palicken@unizwa.edu.om">-palicken@unizwa.edu.om</a></td>
<td>Room 1002-1003 Comercial Building Garden Hotel, XinanTown, Sanshui, Foshan, Guangdong 528100 CHINA Tel: 86-757-87781161 - Fax: 86-757-87781151 Angie Lu, CEO <a href="mailto:angie@chinalabfurniture.com">angie@chinalabfurniture.com</a> Rita Zhang <a href="mailto:sales3@chinalabfurniture.com">sales3@chinalabfurniture.com</a></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>GD Lab Solutions Pvt. Ltd. (E)</strong></th>
<th><strong>HEMCO Corporation (E)</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>50/A Lamdapura Road, Taluka: Salvi, Vadodara-391775, Gujarat, India Tel: 91-9974021700 Mayur Patel, Chairman- <a href="mailto:mayur.patel@gdls.in">mayur.patel@gdls.in</a> Mr. Sujay Pawar - <a href="mailto:sujay.pawar@gdls.in">sujay.pawar@gdls.in</a></td>
<td>711 South Powell Road Independence, MO 64056 Tel: 816 796 2900—Fax: 816 796 3333 Ronald Hill, Pres—<a href="mailto:ronh@hemcocorp.com">ronh@hemcocorp.com</a> David R. Campbell, VP Sales/Mkt <a href="mailto:daviec@hemcocorp.com">daviec@hemcocorp.com</a></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Gas Control Equipment GmbH druva (E)</strong></th>
<th><strong>HOK (AB)</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Weyherser Weg 8, Fulda 36043 Germany Tel: +49 661 8393 0 Fax: +49 661 8393 33 Thomas Lingenberg, Director <a href="mailto:thomas.lingenberg@gcegroup.com">thomas.lingenberg@gcegroup.com</a> Wilhelm Bischoff <a href="mailto:wilhelm.bischoff@gcegroup.com">wilhelm.bischoff@gcegroup.com</a></td>
<td>1065 Avenue of the Americas—6th Floor New York, NY 10018 Tel: 212-741-1200 Jim Berge, <a href="mailto:jim.berge@hok.com">jim.berge@hok.com</a></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Genie Scientific, Inc. (E)</strong></th>
<th><strong>Haldeman-Homme, Inc. (S)</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>17430 Mt. Clifffwood Circle Fountain Valley, CA 92706 Tel: 800.545.881654-1838 Fax: 714-641-0496 Garrett LeVan—<a href="mailto:garrett@genescientific.com">garrett@genescientific.com</a> Kim Holliday - <a href="mailto:Holliday@genescientific.com">Holliday@genescientific.com</a></td>
<td>430 Industrial Boulevard Minneapolis, MN 55413 Tel: 612-362-2114 - Fax: 612-378-2236 Ron Johnson, Exec Vice President <a href="mailto:rjohnson@haldemanhomme.com">rjohnson@haldemanhomme.com</a> Wendy Adrian - 612-362-2115 <a href="mailto:wadrian@haldemanhomme.com">wadrian@haldemanhomme.com</a></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Gleeson Construction, Inc. (S)</strong></th>
<th><strong>Haldeman Lab Furniture (E)</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>189 E. Washington Street Chagrin Falls, OH 44022 Tel: 440-247-8775 - Fax: 440-247-3874 Dragan Dukich, Proj Manager 440 247 8775 <a href="mailto:ddukich@gleesonconstruction.com">ddukich@gleesonconstruction.com</a></td>
<td>814 Mitchell Road Newbury Park, CA 91320 Tel: 805 498 3121, - Fax: 805 498 1855 Joseph Matta - Pres &amp; CEO—<a href="mailto:Joe@hansonlab.com">Joe@hansonlab.com</a></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Godrej &amp; Boyce Mfg. Co., Ltd. (E)</strong></th>
<th><strong>Herais Int’l General Trading, Ltd. (S)</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Godej Interio, Plant 4, Pirojsha Nagar LBS Marg, Vikhroli (W) Mumbai 400079 India Tel: 91 226 796 2475 - Fax: 91 226 796 1503 Sameer Joshi, Sr. GM <a href="mailto:-samjo@godrej.com">-samjo@godrej.com</a></td>
<td>1908 Jalna Boulevard London, ON, N6E 3S6 CANADA Tel: 519 800-1353 Fax: 519-601-7770 Raja HajMahmoud—<a href="mailto:higtc@windowslive.com">higtc@windowslive.com</a></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Green Laboratory Equip. Co., Ltd. (S)</strong></th>
<th><strong>(E) Executive Member (S) Sustaining Member (A) Associate Member (AB) Advisory Board</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Room 619 No. 111 East Songqiao Road BaoShan Area, Shanghai 200940 CHINA Tel: 86-21-61677525 - Fax: 86-21-61677538 Jenny Lei, Gen Mgr—<a href="mailto:jenny@greenlab.net">jenny@greenlab.net</a></td>
<td></td>
</tr>
</tbody>
</table>
SEFA Member Directory  
(4/15/2017)

HOYE Shanghai Laboratory System Engineering Co., Ltd. (S)  
Rm 305, Bldg. 18 No. 658 Jinzhong Road  
Shanghai 200335 CHINA  
Tel: +86-021-63816985 Fax: +86-021-638-16987  
Cooper Wang - Mgr cooper.wang@hoyelab.com  
Andy Chen - andy.chen@hoyelab.com

Hunan Longsea Modern Lab Equipment Co., Ltd. (E)  
Rm 01-03, Fl. 19, Building 3, New Long Sea Plaza  
Changsha, Hunan 410100 CHINA  
Tel +86-13548650028 Fax +86-731-84015863  
Mr. Yongjun Hu, Gen’l Mgr. 418345158@qq.com  
Dan Xiao - 2822434266@qq.com

Industrial Laborum Ibérica, SA (E)  
R. Marcelino Sá Pires, N.15, 5º, Sala 56  
S. José Sao Lázaro, Braga 4700-924 Portugal  
Tel +351 234 529 500 Fax +351-234-525 263  
Hugo Lapa, CEO  
hugolapa@industriallaborum.com  
alexandremanaia@industriallaborum.com

Inomoba (E)  
Netzahualpilli s/n,  
El Marques, Qro. 76240 Mexico  
Tel: +52-4422774593  
Manuel Feregrino, Design Leader  
manuel.feregrino@inomoba.com

Institutional Casework, Inc. (E)  
1865 Highway 641 North, Paris, TN 38242  
Tel: 731 642 4251 — Fax: 731 642-4262  
Jim Arthurs, Pres. & CEO JArthurs@iciscientific.com  
Wayne Cathey - WCathey@iciscientific.com  
Ron Arredondo - ronald@iciscientific.com

Integrated Cleanroom Tech. Pvt., Ltd. (E)  
#303 Surabhi Lotus, Nagarjunna Nagar Colony,  
Ameerpet, Hyderabad,  
Andhra Pradesh 500073 INDIA  
Tel: +91 40 23792024 Fax: +91 40 23792025  
K. Koteswara Rao, VP project@icleantech.com  
C.M. Rao — cmrao@icleantech.com

Inter Dyne Systems, Inc. (E)  
676 East Ellis Road,  
Norton Shores, MI 49441  
Tel: 231-799-8760 - Fax: 231-799-9690  
Jack Andree, Pres - jack@interdynesystems.com

Iron Horse Architects (AB)  
475 17th Street Ste 720  
Denver, CO 80202  
Tel:710-855.7672  
Victoria David - victoria.david@ironhorse.email

Jacobs Consultancy (AB)  
303 South Broadway, Suite G20  
Tarrytown, NY 10591  
Tel: 914-333-1116  
Josh Meyer - Principal - josh.meyer@jacobs.com

Jeio Tech Company, Ltd. (E)  
153 Techno 2 Ro, Yuseong-gu  
Daejeon 305-500 South Korea  
Tel: 82-42-933-4296 - Fax: 82-42-933-4293  
Byung Sam Park pbos0926@jeiotech.com  
Eric Stimac—Estimac@jeiotech.com

Jiangsu Cartmay Industrial Co., Ltd. (E)  
Weifu Road No. 32 Weixing Industrial Park,  
HengLin Town Changzhou, JiangSu 213103 CHINA  
Tel: 86-519-88500208 - Fax: 86-519-88500728  
Guangqing Chen, Dep. GM - info@labfurniture.asia

Jiangsu Kylin Science & Education Equipment Co., Ltd. (E)  
7 Kaicheng Road, Kylin Street, Jiangning District  
Nanjing City, Jiangsu 211135 CHINA  
Tel: 86-0251-84128848 - Fax: 86-0251-84126059  
Ge Yu Meng — 1227012918@qq.com

JUSTRITE Mfg., Company L.L.C. (E)  
2454 Dempster Street Ste 300  
Des Plaines, IL 60016  
Tel: 847.612.3515 - Fax: 219.362.9296  
Gregory L. Rice Sales Director -The Americas  
grice@justritemfg.com

* (E) Executive Member  (S) Sustaining Member  (A) Associate Member  (AB) Advisory Board
SEFA Member Directory
(4/15/2017)

Kewaunee Scientific Corp. (E)
P.O. Box 184, Statesville, NC 28677
Tel: 704.873.7202—Fax: 704 873 5106
Dana Dahlgren, VP Sales/Mktng 704 871 3235
danadahlgren@kewaunee.com
Kurt Rindoks, VP Eng. 704.871.3226
kurtrindoks@kewaunee.com
Karole Clanton karoleclanton@kewaunee.com

Kirksey Architects, Inc. (AB)
6906 Portwest Drive
Houston, TX  77024
Tel: 713-850-9600
Brian P. Richard - brianr@kirksey.com

Kloppenberg & Co. (E)
2627 West Oxford Avenue
Englewood, CO  80110
Tel: 800.346.3246—Fax: 303.789.1741
Brian Wilde - bwilde@kloppenberg.com

Köttermann GmbH & Co KG (E)
Industriestraße 2-10 -D-31311 Hänigsen
Hannover, Niedersachsen  31311 Germany
Tel: +49 5147 976-590 -Fax: +49 5147 976-590
Mr. Tobias Thiele, Managing Director
Tobias.Thiele@koettermann.com
Natalie Karau - Natalie.Karau@koettermann.com

LM Air Technology, Inc. (E)
1467 Pinewood Street
Rahway, NJ  07065
Tel: 732-381-8200 Ext 304- Fax:732-381-4091
Peter Daniele—peted@lmairtech.com

Labconco Corporation (E)
8811 Prospect Avenue, Kansas City, MO 64132
Tel: 816.333.8811 - Fax: 816-363.0130
Tom Schwaller, VP - tschwaller@labconco.com
Kevin Gilkison, VP kgilkison@labconco.com

Lab Crafters, Inc. (E)
2085 Fifth Avenue, Ronkonkoma, NY 11779
Tel: 631 471 7755 - Fax: 631 471 9161
Robert Deluca, CEO- rdeluca@lab-crafters.com
Bob Deluca Jr., Pres- bdelucajr@lab-crafters.com

Labguard India Pvt., Ltd. (E)
M6/7 Neighbourhood Complex Sector 4
Nerul (W), Navi Mumbai,
Maharashtra 400706 India
Tel: 91-022-25986090 - Fax: 91-022-25335940
Prakash Sansare —sales@labguard.biz

LabIndia Instruments Pvt., Ltd. (S)
201, Nand Chambers, LBS Marg,
Near Vandana Cinema
Thane, Maharashtra 400602 India
Tel: 91-22-27721123 - Fax: 91-22-27723164
Dr. Rohan Bhalerao -rohansb@labindia.com
Lalit Bhambhani - lalitb@labindia.com

Laborplaner Tonelli AG (AB)
Rickenbacherstrasse 29
CH-4460 Gelterkinden
Tel. +41 61 983 11 86
Dario Tonelli - dario.tonelli@laborplaner.ch

LabPlus Laboratory Furniture Mfg. (E)
Post Box 2315
Ras Al Khaimah, UAE  2315
Tel: 00971-7-2352250 - Fax: 00971-7-232210
Faisal Bin Humaid Al Qassimi, Chairman
labplus@eim.ae
Riyaz Mohammed, GM - riyaz@labplus-uae.com

Labtec, LLC. (E)
P.O. Box 4275
Sharjah, UAE 4275
Tel: 971-06-534-44-80 - Fax: 971-06-53-44-81
Muhammad Tariq, GM - mohd.tariq@labtec.llc

Lexus Muebles Diseños (E)
Felipe Carrillo Puerto 1001-2K Ind. Benito
Juarez, Queretaro 76130 MEXICO
Tel: 011-52-442-217-0431
Jose Rivera Frausto, GM - jriveragro@hotmail.com

Maani & Partners (E)
P.O. Box 927161 Amman-Al-Yadoudah
Main Maddabah Street
Amman 927161 Jordan
Tel: 962- 6 412 9119 - Fax: 962- 6 412 9339
Omar Tarawneh, Proj Mgr Omar_t@maani.com

* (E) Executive Member    (S) Sustaining Member
(A) Associate Member    (AB) Advisory Board
SEFA Member Directory (4/15/2017)

Modern Lab Interior (E)
No. 109 G.N. Chetty Road, C-Block A2 Flat
T.Nagar Chennai, Tamilnadu 600 017 INDIA
Tel: 91-44-2834 6444 - Fax: 91-44-2834 6445
Rajthilak Raja rajthilakraja@gmail.com
Selvi - labinterio1972@gmail.com

Mott Manufacturing Ltd. (E)
452 Hardy Road.
Brantford, Ontario N3T-5L8 Canada
Tel: 519-752-7825 - Fax: 519-752-2895
Edward Seegmiller, CEO - Ext 211—eds@mott.ca
Mario Di Fonte Ext 218 - mdifonte@mott.ca

MultiLab, LLC (E)
18784 174th Avenue
Spring Lake, MI 49456
Tel: 616.846.6990
Charlotte Merrill - cmerrill@multilabllc.com
Mark Deal - mdeal@multilabllc.com

Nuova Far S.R.L. (E)
Via Matteotti 88/B15
Prato Sesia, Italy 28077
Tel: +39 0163 852 634 - Fax: +39 0163 850 663
Albertone Michele - info@farlabs.com

OnePointe Solutions, LLC (E)
8801 Wall Street Ste 840
Austin, TX 78754
Tel: 512.982.1973 - Fax: 512.982.1974
Don Carlson - dcarlson@onepointesolutions.com

Oriental Giken Inc. (E)
Confort Yasuda Bldg. 2-9 Kanda Nishiki-Cho
Chiyoda-Ku, Tokyo 101-0054 Japan
Tel: 81-3-3233-0821 - Fax: 81-3 3233 0825
Ken Karasawa-k-karasawa@orientalgiken.co.jp
Itsuka Kato—i-kato@orientalgiken.co.jp

PG LifeLink (E)
167 Gap Way
Erlanger, KY 41018
Tel: 859.283.5900 - Fax: 859.372.6272
Karen Dorman - kdorman@pglifelink.com
Dave Schwettman - daves@pglifelink.com

Pal-Lab Experimental Equip. Co. Ltd. (E)
Huguang Road, Taodu Development Zone
Yixing Wuxi, Jiangsu 214222 CHINA
Tel: 86-510-8789888 - Fax: 86-510-87830000
Jiaying Zhai, GM - web@pal-lab.com
Bob Zhang - bob@pal-lab.com

Payette (AB)
290 Congress Street, Fifth Floor
Boston, MA 02210-1005
Tel: 617-895-1000- Fax: 617-895-1002
Charles Klee - cklee@payette.com

Perkins + Will (AB)
1315 Peachtree NE
Atlanta, GA 30309
Tel: 404-873-2300
Dan Watch, Principal - dan.watch@perkinswill.com

Protech Company (E)
P.O. Box 927621— Sahab Industrial State
Second Gate to Industrial School
Amman 11190 Jordan
Tel: 962-6-5370033—Fax: 962-6-5370034
Hisham Abdein, GM info@protech.com.jo
Jamal Rzouk - qmr@protech.jo

Rafael Viñoly Architects PC (AB)
50 Vandam Street
New York NY 10013
Tel: 212-924-5060
Jay Bargmann, Sr. Vice Pres. - jdb@rvapc.com

Research Facilities Design (AB)
3965 Fifth Avenue, Suite 400
San Diego, CA 92103-3107
Tel: 619-297-0159 - Fax: 619-294-4901
Lloyd Fisk, AIA, LEED AP - lf@rfd.com

Rex Bousfield Holdings, Ltd., (S)
Wireless Road, Biggin Hill
Kent TN16 3BW United Kingdom
No. 3131 Kaixuan Road,
Shanghai, 200030 CHINA
Tel: 44(0)1883717033 - Fax: 44(0)1883717890
Robert Bousfield- Robert.bousfield@bousfield.com

* (E) Executive Member       (S) Sustaining Member       (AB) Advisory Board

© SEFA - 5th Edition Desk Reference - Version 2.0
SEFA Member Directory
(4/15/2017)

Riyadh Furniture Ind. Co. (E)
P.O. Box 211—Street #15 2nd Industrial City
18 KM New Al Khairj Road
Riyadh 11383 Saudi Arabia
Tel: 966-1-498-0808 - Fax: 966-1-498-1216
Abdullah Alomair—info@athath.com

Rotarex, N.A., (E)
101 Bilby Road - Bldg #2
Hackettstown, NJ 07840
Tel: 724-696-4340 - Fax: 724-696-4364
William Hald - hald.william@rotarex.com
Gerhard Stefan - Gerhard.Stefan@rotarex.com

S & F Laboratory Enterprises (E)
FL 2, Build 2 No. 518 Xinzhuang Road
Xincaohejing Industrial Park
Shanghai, CHINA 201612
Tel: 86-21-61678158 - Fax: 86-21-67766330
Felice Chen, CEO—chenliyue@sfscl.com
Leo Wu - wuzhaocu@sfscl.com

Samin Science Co., Ltd. (E)
27 Entibuei 4-ro, 48Beon-gil, Danwon-gu,
Ansan-si, Gyeonggi-do, 15610 South Korea
Tel: 82-31-433-8941 - Fax: 82-31-433-8943
Seunghoon Lee - global@saminsci.com

SAN Group (E)
Room 1101 No. 18 Gufang Road
Shanghai, 201102 CHINA
Tel +021 34120616—Fax +021 34120568
Kitty Wang, Director export@sanchina.com.cn

Scientific Plastics, Inc. (E)
1016 Southwest Blvd., Kansas City, KS  66103
Tel: 800-558-2027 - Fax: 800-548-0448
Patricia Bartley - pbartley@scientificplastics.com

Selinsgrove Institutional Casework d/b/a Wood Metal Industries (E)
100 East Sherman Street
Selinsgrove, PA  17870
Tel: 570-374-1176 - Fax: 570-374-5010
Scott Groce, Vice Pres. scottg@wood-metal.com
Karen Saylor karens@wood-metal.com

Shanghai Aosh Ind. Dev. Co., Ltd. (S)
3/F Bldg D-1 No. 128 Shenfu Road,
Xinzhuang Ind. Dist.
Shanghai 201108 CHINA
Tel: 86-21-52100002 Fax: 86-21-52100001
Zhichao Chen, General Mgr - cc@aoshlab.com
Joyce Wang - joyce.wang@aoshlab.com

Shanghai Beta Lab Furniture Co., Ltd. (S)
Rm 606 Jiading Bldg #1033  Moyu South Road
Anting Town Jiading, Shanghai 201805 CHINA
Tel: 86-21-65617410 Fax: 86 –21-59952292
Zhang Xike, Gen Mgr. beta2000518@163.com
Angie Lu - angie@chinalabfurniture.com

Shanghai Hanguang Ind. Co. Ltd. (S)
Room 7A Blk A No. 209 Wendang Road
XuHui District Shanghai,
200030 CHINA
Tel: 86-21-64394396 -Fax: 021-64394396-822
Sophie Deng— sophie@ hanguangsh.com

Shanghai Hongdi Lab Sys. Co. Ltd. (S)
Room 2006, Mingshen Centre, Mansion
No. 3131 Kaixuan Road, Shanghai,
200030 CHINA
Tel: 86-021-54071219 -Fax: 021-5407 1223
Lily Chen— Lily.chen@astec.com.cn

Shanghai HuShi Chemical Reagent & Analysis Instrument Co., Ltd. (E)
7F, No. 26, 28 Jiangchang No. 3 Rd.
Shanghai, China 200436
Tel: 86-021-36321658 - Fax: 86-021-36321580
Zhao Chunyun, Gen'l Engineer - zcy@shhushi.com

Shanghai Road Lab Equip. Co. Ltd. (E)
Room 601 Building 3 No. 168 Jixiu Road
Minhang District, Shanghai 201104 CHINA
Tel +021 50373141—Fax +021 34720910
Bob Xu - Gen. Mgr. bob.xu@21toplab.com
Zhang Xiaofen - sue.zhang@21toplab.com

Shanghai Surpeak Eng. Tech. Co., (S)
2F, No. 2 Building, No. 2653 Hunan Road
Shanghai 201315 CHINA
Tel. 86.21.60975596 —Fax 86.21.60975517
Yangjun Chen - Gen. Manager. cjy@surpeak.cn
Weijun Chen - cjy@surpeak.cn

(A) Associate Member     (AB) Advisory Board

* (E) Executive Member       (S) Sustaining Member

© SEFA - 5th Edition Desk Reference - Version 2.0
Shanghai Tech Labway Co., Ltd. (E)
21F, No. 1200 Pudong Avenue
Pudong District, Shanghai 200135 CHINA
Tel: 86-021-58523132 Fax: 86 –021-58520485
Herrick Ho, Gen Mgr. - herrick@techlab.com.cn
Sandy Wang - sandy@techlab.com.cn

Shanghai Topsci Lab Equip Co., Ltd. (S)
Floor 15 No. Oasis Central Bldg., Jinshajiang Road,
Putuo District, Shanghai 200333 CHINA
Tel 86 21 51987060 - Fax 86 21 54305171
Jin Ping - ts1lab031@163.com

Shanghai WeiGui Laboratory Equipment Co., Ltd., (S)
No. 14 BaiMaTang, Huaxin Town Qingpu District
Shanghai, 201700 CHINA
Tel +86.21.59591812  - Fax +86.21.69580616
Jun Xia - Gen Mgr. jun.xia@Yifan-SH.com

Shanghai Zhicheng Lab Equipment (S)
Fl 25, Building A, No 168 Yuyuan Road,
Shanghai 200040 CHINA
Tel +021 51688948—Fax +021 61924138
Sandy Cong, Proj Mgr. sandy.cong@labexpert.cn

Shanghai Zhongling Lab Equipment Group Co., Ltd. (E)
No. 518 Dongxue Road, Dongling Town
Songjiang District, Shanghai 201619 CHINA
Tel +86 139 17657878 - Fax +86 21 57870668
Ren Xudong, Gen’l Mgr 676226897@qq.com
zl@zllab.com.cn

Cheng Wei Feng - 13802583710@163.com

Shelton Laboratory Systems (E)
P.O. Box 836
Crystal Springs, MS 39059
Tel: 601-892-7105 - Fax: 601-892-3311
Eddie Adkins, Pres -eadkins@sheldonlabs.com
Justin Lawson - JSlawson@sheldonlabs.com

Shenzhen Chuangmei Ind. Co., Ltd. (E)
Volab Ind. Park No. 3 Huangdiyin Ind Zone
Guanlan, Longhua New District
Shenzhen, Guangdong 518000 China
Tel: 86-075586016366 - Fax: 86-07556016399
Catherine Song, Int’l Mgr - marketing@volab.cn

Shenzhen JHS Industrial Co., Ltd. (E)
Blink 2 2nd Floor, Bldg 2 Nanyou Tianan Ind Park
Dengliang Road, Nanshan District
Shenzhen, Guangdong 518054 China
Tel: 86-75526430837 - Fax: 86-75526430853
Zhu Xiaoxi, Gen Mgr. - 13802583710@163.com

Sinopharm Chemical Reagent Co., (E)
No. 52 Ningbo Road
Shanghai 200002 CHINA
Tel: 86-21-63211830 - Fax: 86-21-63391322
Huan Hui, Manager 13917034163@163.com
Zhang Li 18800310232@163.com

Smith Group (AB)
500 Griswold Street Ste 1700
Detroit, MI 48226
Tel: 313-442-8459 - Fax: 313-442-8297
Victor Cardona Victor.cardona@smithgroup.com

Staubli Corporation (E)
201 Parkway West, Duncan, SC 29334
Tel: 864-846-5455 - Fax: 864-486-5495
Bobby Cranford—b.cranford@staubli.com
Vanessa Garcia - v.garcia@staubli.com

Steel Case India (E)
2nd Fl. 40 Nagardas Mansion, Bhagat Singh Rd
Vile Parle (West), Mumbai 400 056 (India)
Tel: 91-22-2671 4967—Fax: 91-22-2628 8177
Shubhendu K. Bhuta skb.steelcase@gmail.com

* (E) Executive Member  (S) Sustaining Member  (A) Associate Member  (AB) Advisory Board
<table>
<thead>
<tr>
<th><strong>Stevens Industries, Inc. (E)</strong></th>
<th><strong>Texlab Scientific Equipment Co., Ltd. (E)</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>704 West Main Street</td>
<td>No. 599 Heguo Road, Baihe Town</td>
</tr>
<tr>
<td>Teutopolis, IL 62467</td>
<td>Qingpu District, Shanghai 201709 CHINA</td>
</tr>
<tr>
<td>Tel: 217-857-7100 - Fax: 217-857-7101</td>
<td>Tel: 86-21-5973779 - Fax: 86-21-59743929</td>
</tr>
<tr>
<td>Jeremy Hickenbottom - <a href="mailto:jeremyh@stevensind.com">jeremyh@stevensind.com</a></td>
<td>Annie Wang, Gen’l Mgr - <a href="mailto:annie@texlab.com.cn">annie@texlab.com.cn</a></td>
</tr>
<tr>
<td>Ed Roedl—<a href="mailto:edr@stevensind.com">edr@stevensind.com</a></td>
<td>Grace Weng - <a href="mailto:grace@texlab.com.cn">grace@texlab.com.cn</a></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Suzhou Great Laboratory Eng.,Co., (E)</strong></th>
<th><strong>The S/L/A/M Collaborative (A)</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>No. 428 Sufu Road</td>
<td>80 Glastonbury Boulevard</td>
</tr>
<tr>
<td>Suzhou, Jiangsu 215000 China</td>
<td>Glastonbury, CT 06033</td>
</tr>
<tr>
<td>Tel: 86-512-6519-8803 - Fax: 86-0512 6519-8813</td>
<td>Tel: 860.657.8077 - Fax: 860.657.3141</td>
</tr>
<tr>
<td>Jifeng Cao, Vice Gen.Mgr. <a href="mailto:caojifeng@labgreat.com">caojifeng@labgreat.com</a></td>
<td>Jeff Talka, S&amp;T Leader - <a href="mailto:talka@slamcoll.com">talka@slamcoll.com</a></td>
</tr>
<tr>
<td>Fabang Shao <a href="mailto:shaofabang@labgreat.com">shaofabang@labgreat.com</a></td>
<td>Dave Edwards - <a href="mailto:edwards@slamcoll.com">edwards@slamcoll.com</a></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Suzhou Tnew Lab System Eng.,Co., (S)</strong></th>
<th><strong>TOOK Tech Co., Ltd. (E)</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>2502 Wuzhong Mall Bldg.</td>
<td>Room 2803 F28 Bldg 13 No. 8 Middle Huarong Rd.</td>
</tr>
<tr>
<td>No. 388 Dongwu South Road, Wuzhong District</td>
<td>Beijing 100176 CHINA</td>
</tr>
<tr>
<td>Suzhou 215006 China</td>
<td>Tel 010-57862368</td>
</tr>
<tr>
<td>Tel: 86-137 7180 0924 - Fax: 86-0512 68363936</td>
<td>Yanyan Liu - <a href="mailto:liuyanyan@tooktops.com">liuyanyan@tooktops.com</a></td>
</tr>
<tr>
<td>Steven Zhao, GM - <a href="mailto:steven.zhao@tnewlab.com">steven.zhao@tnewlab.com</a></td>
<td>Dong Guobin <a href="mailto:dongguobin@139.com">dongguobin@139.com</a></td>
</tr>
<tr>
<td>Emily <a href="mailto:Chen@tnewlab.com">Chen@tnewlab.com</a></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>TFI Inline Design Corp. (E)</strong></th>
<th><strong>Trespa BV (E)</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>5658 East 58th Avenue</td>
<td>62 Greene Street</td>
</tr>
<tr>
<td>Commerce City, CO 80022</td>
<td>New York, NY 10012</td>
</tr>
<tr>
<td>Tel: 303-288-6823 - Fax: 303-288-6876</td>
<td>Tel: 212-344-7122 —Fax: 866-298-3499</td>
</tr>
<tr>
<td>Frank Conner, Pres <a href="mailto:fconner@tfiinlinedesign.net">fconner@tfiinlinedesign.net</a></td>
<td>Val Ross 303-472-8365 <a href="mailto:v.ross@trespa.com">v.ross@trespa.com</a></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>TMI Systems Corporation (E)</strong></th>
<th><strong>Ultra Labs, Inc. (E)</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>50 South Third Avenue West</td>
<td>1180 Jiujing Road, Songjiang Hi-tech Park</td>
</tr>
<tr>
<td>Dickinson, ND 58601</td>
<td>Shanghai 201615 CHINA</td>
</tr>
<tr>
<td>Tel: 701-456-6716 - Fax: 701-456-6700</td>
<td>Tel: 86-21-676-96869 - Fax: 86-21-676-96826</td>
</tr>
<tr>
<td>Kevin Kovash, Sr. Vice President - 701-456-6355</td>
<td>Jason Mao, Gen. Mgr- <a href="mailto:jasonmao@ultralabs.com.cn">jasonmao@ultralabs.com.cn</a></td>
</tr>
<tr>
<td><a href="mailto:Kevin.kovash@tmisystems.com">Kevin.kovash@tmisystems.com</a></td>
<td>Allen Mao — <a href="mailto:allenmao@ultralabsllc.com">allenmao@ultralabsllc.com</a></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Tecnología en Laboratorios, S.A. de C.V. (E)</strong></th>
<th><strong>Vacuubrand, Inc. (E)</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Acceso A #109-7 Fraccionamiento Industrial Jurica</td>
<td>11 Bokum Road</td>
</tr>
<tr>
<td>Queretaro, MEXICO 76120</td>
<td>Essex, CT 06426</td>
</tr>
<tr>
<td>Tel: 52-442-218-5229 Fax: 52-442-218-1800</td>
<td>Tel: 860.767.5341 —Fax: 860.767.2563</td>
</tr>
<tr>
<td>Enrique de la lata Gomez - [email protected]@tecnolab.com.mx</td>
<td>Peter G. Coffey, VP Marketing (ext 118)</td>
</tr>
<tr>
<td>Gabriel de la Llata Gomez - [email protected]@tecnolab.com.mx</td>
<td><a href="mailto:pcoffey@vacuubrand.net">pcoffey@vacuubrand.net</a></td>
</tr>
<tr>
<td></td>
<td>Peter Beck - 312.972.3993</td>
</tr>
<tr>
<td></td>
<td><a href="mailto:pbeck@vacuubrand.net">pbeck@vacuubrand.net</a></td>
</tr>
</tbody>
</table>

* (E) Executive Member            (S) Sustaining Member          (A) Associate Member       (AB) Advisory Board
SEFA Member Directory  
(4/15/2017)

Waldner Laboreinrichtungen (E)  
Haidoesh 1, 88239 Wangen im Allgaeu, Germany  
Tel: +49 7522 986-174 Fax: +49 7522 986-79-174  
Max Kriegel - Product Manager  
Maximilian.Kriegel@waldner.de  
Javier Arguedas-javier.arguedas@waldner-inc.com

Water Saver Faucet Co. (E)  
701 West Erie Street  
Chicago, IL 60610  
Tel: 312-666-5500 - Fax: 312-666-5501  
Steven Kersten, Pres—skersten@wsflab.com  
Michael Straughn - mstraughn@wsflab.com

Wilsonart Shanghai (E)  
Rm 1118 No. 2025 West Zhong Shan Road  
Shanghai 200235 China  
Tel: +86 21 64397070 - Fax: +86 21 64397605  
Peggie Zhao: Peggie.Zhao@wilsonart.com.cn

Withee Works, LLC (A)  
1540 Capitol Drive, Ste 104  
Green Bay, WI 54303  
Tel: 920.737.8477  
David Withee, Pres. - dwithee@witheeworks.com

Workstation Industries (E)  
1938 East Pomona Street, Santa Ana, CA 92705  
Tel: 714.258.7535 - Fax: 714.258.1057  
Albert Capello, President  
albert@workstationindustries.com

Yamato Scientific Co., Ltd. (E)  
2-2-1 Nihonbashi-Muromachii  
Chuo-ku, Tokyo 103-0022 JAPAN  
Tel: 81-3-5639-70910 Fax: 81-3-5639-6031  
Nobuo Kakehi, Director kakehi@yamato-net.co.jp  
Setsuo Hikino — hikino@yamato-net.co.jp

Zeba Lab Furniture Pvt. Ltd. (E)  
P.O. Box 3130, Kakkand,  
Cochin, Kerala 682030 INDIA  
Tel: 91-0484-2415112 - Fax: 91-0484-2415212  
Jiji Manikkath—contact@zebalabs.com  
Jane Ragu—jane@zebalabs.com

Zephrus Intelligence & Technology (Shanghai) Co. Ltd. (S)  
15/F Innovation Building, 1009 Yi Shan Road  
Shanghai 200233 CHINA  
Tel: 86-21-51693045 - Fax: 86-21-61927276  
Alwin Wang, Gen Mgr. alwin@zephirus.com  
Nelson Yang — Nelson@zephirus.com

Zhejiang Rexin Decorative Material Co. Ltd., (E)  
Room 1002 No. 1076 Changshou Road  
Shanghai 200042 CHINA  
Tel: 86-21-52562968 - Fax: 86-21-52562866  
Tracy Guo - Deputy GM - tracyrexin@163.com  
Jenny Hu - marketing@rexin@163.com

* (E) Executive Member  (S) Sustaining Member  (A) Associate Member  (AB) Advisory Board
SEFA’s Advisory Board
Co-Chairmen

Lloyd Fisk, RFD
Charles Klee, Payette Associates

Jay Bargmann  Rafael Viñoly
Jim Berge  HOK
Victor Cardona  Smith Group
TH Chang  T.H. Chang Consulting
Victoria David  Iron Horse Architects
Punit Jain  Cannon Design
Josh Meyer  Jacobs Consultancy
Bruce Nepp  abell nepp
Brian Richard  Kirksey Architects
Dario Tonelli  LaborPlaner Tonelli A.G.
Dan Watch  Perkins + Will
# SEFA’s Past Chairmen

<table>
<thead>
<tr>
<th>Name</th>
<th>Company</th>
</tr>
</thead>
<tbody>
<tr>
<td>N. Roy Anderson</td>
<td>Fisher Scientific</td>
</tr>
<tr>
<td>Joseph P. Ingarra</td>
<td>Duralab</td>
</tr>
<tr>
<td>Kenneth Hanson</td>
<td>Hanson Furniture</td>
</tr>
<tr>
<td>Robert Antonio</td>
<td>Prime Industries</td>
</tr>
<tr>
<td>Roger Lethander</td>
<td>Leonard Peterson &amp; Co.</td>
</tr>
<tr>
<td>Chip Albright</td>
<td>Jamestown Metal</td>
</tr>
<tr>
<td>Dave Withee</td>
<td>Broen A/S</td>
</tr>
<tr>
<td>William Stover</td>
<td>Mott Manufacturing Ltd.</td>
</tr>
<tr>
<td>Mike Kloosterman</td>
<td>The Durcon Company</td>
</tr>
<tr>
<td>Ken Dixon</td>
<td>Air Control, Inc.</td>
</tr>
<tr>
<td>Richard Johnson</td>
<td>Thermo Fisher Scientific</td>
</tr>
<tr>
<td>Dana Dahlgren</td>
<td>Kewaunee Scientific</td>
</tr>
<tr>
<td>Kevin Kovash</td>
<td>TMI Systems Corporation</td>
</tr>
<tr>
<td>Tom Schwaller</td>
<td>Labconco Corporation</td>
</tr>
</tbody>
</table>
Scientific Equipment & Furniture Association

BY-LAWS

SEFA World Headquarters
65 Hilton Avenue
Garden City, NY 11530

Tel: 516-294-5424
Fax: 516-294-2758
www.sefalabs.com

SEFA SPELLS SAFE
# Table of Contents

<table>
<thead>
<tr>
<th>Article</th>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Name</td>
<td>25</td>
</tr>
<tr>
<td>2.</td>
<td>Purpose</td>
<td>25</td>
</tr>
<tr>
<td></td>
<td>Section 2.1 General Objectives &amp; Scope</td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td>Membership</td>
<td>25</td>
</tr>
<tr>
<td></td>
<td>Section 3.1 Classes of Membership</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Section 3.2 Election to Membership</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Section 3.3 Right to Vote, Hold Office and Receive Membership Benefits</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Section 3.4 Use and Display of SEFA Logos and Trademarks</td>
<td></td>
</tr>
<tr>
<td>4.</td>
<td>Dues</td>
<td>28</td>
</tr>
<tr>
<td>5.</td>
<td>Government</td>
<td>28</td>
</tr>
<tr>
<td></td>
<td>Section 5.1 Officers</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Section 5.2 Board of Directors</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Section 5.3 Nomination to the Board of Directors</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Section 5.4 Duration of Tenure</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Section 5.5 Removal of Officers and Directors</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Section 5.6 Duties of the Chairman</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Section 5.7 Duties of the Vice Chairman</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Section 5.8 Duties of the Secretary/Treasurer</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Section 5.9 Bonding of Officers</td>
<td></td>
</tr>
<tr>
<td>6.</td>
<td>Committees</td>
<td>30</td>
</tr>
<tr>
<td>7.</td>
<td>Meetings</td>
<td>30</td>
</tr>
<tr>
<td></td>
<td>Section 7.1 Annual Meeting of the Association</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Section 7.2 Special Meetings of the Association</td>
<td></td>
</tr>
</tbody>
</table>
Table of Contents

Section 7.3 Quorum at the Meetings of the Association
Section 7.4 Voting by Members of the Association
Section 7.5 Quorum and Voting Annual Meeting of the Association
Section 7.6 Ratification

Article 8. Termination of Membership 31
Section 8.1 Non-Payment of Dues
Section 8.2 Resignation
Section 8.3 Suspension or Expulsion
Section 8.4 Reinstatement of Membership

Article 9. Interest in Association Funds and Property 32
Article 10. Dissolution 32
Article 11. Indemnification of Directors and Officers 32
Article 12. Rules and Regulations 33
Article 13. Amendments 33
SEFA Meetings Policy Statement 33
BY-LAWS
OF THE
SCIENTIFIC EQUIPMENT AND FURNITURE ASSOCIATION
(As Amended November 18, 2016)

Article 1. Name

The name of the Association shall be the SCIENTIFIC EQUIPMENT AND FURNITURE ASSOCIATION.

Article 2. Purposes

Section 2.1 General Objectives and Scope

(a) The association was founded to promote the scientific equipment and furniture industry and to improve the quality, safety and timely completion of laboratory facilities in accordance with customer requirements. The Scientific Equipment and Furniture Association consists of firms, architects, lab planners, consultants and dealers, which have as one of their principal businesses the manufacture or design of scientific equipment or furniture or laboratories. These firms sell to research, industrial, life sciences, education and/or government laboratories.

(b) In furtherance of the foregoing, and with full recognition of the right of each member individually to determine its individual business policies, the objectives of the Association shall be:

1. To strengthen the capabilities of its members through education and information exchange.

2. To provide a forum to its members through which the industry's objectives can be furthered.

Article 3. Membership

Section 3.1 Classes of Membership

There shall be the following four classes of membership in the Association:

(a) Executive Member:

To be eligible for Executive Membership in the Association the applicant shall complete the SEFA Membership Qualification Statement. The SEFA Board of Directors shall then determine that the following qualifications have been established:

1. Applicant must control the design and manufacture of one or more of the following laboratory grade products: laboratory furniture, fume hoods, laboratory
work surfaces, fixtures, or related laboratory equipment. Control to be defined as conducting actual design and fabrication, internally, at applicant owned/leased and controlled, manufacturing facility. Fabrication out-sourcing to non-applicant owned or leased facilities does not qualify as eligible work.

2. Applicant must have successfully completed at least ten (10) laboratory furniture projects within three (3) years of submitting its application for Executive Membership.

3. Applicant shall submit two (2) letters of reference - one from a supplier that applicant has a current business relationship with and one from an owner, architect or lab planner that the applicant has worked with. In addition, applicant must provide the name of a SEFA Member in Good Standing who will support its application in writing.

4. Applicant shall also submit a certified test report from a SEFA-approved testing facility, establishing that the applicant manufactures laboratory furniture or related equipment at its manufacturing facility which complies with at least one of SEFA’s Recommended Practices in effect at the time the membership application is submitted by the applicant.

5. All Companies which are Executive Members as of the date these amended by-laws become effective shall have twelve (12) months from that date to submit their product for testing in accordance with Section 3.1 (a)(4) above. The Member will be given an additional six (6) months to establish that their product is SEFA compliant.

6. In determining a member or applicant’s qualifications to become or remain an Executive Member, the Board reserves the right to require a factory inspection by a SEFA –approved testing facility. Such inspection shall be at the expense of the applicant or member.

(b) Advisory Board Member:

1. Advisory Board Members must belong to a professional organization such as AIA, ASHRAE, IFMA or a comparable organization outside of the United States, for a period of at least ten (10) years and have at least eight (8) years of experience in planning and designing laboratory spaces or buildings.

2. Advisory Board Members must also have obtained a degree in architecture or engineering from an appropriately accredited college or university and served as a project architect, lab planner, chief engineer or project manager on at least five (5) lab projects.

3. Advisory Board Members shall be nominated and approved by a majority vote of SEFA’s Board of Directors. Advisory Board Members shall serve for a term of at least three years. The number of Advisory Board Members shall be at the discretion of the Board of Directors.

(c) Sustaining Member:

To be eligible for Sustaining Membership in the Association the applicant shall complete the SEFA Membership Qualification Statement. The SEFA Board of Directors shall then determine that the following qualifications have been established:
1. A Sustaining Member applicant shall be a company that purchases laboratory furniture and/or related equipment manufactured by others and enters into subcontract agreements to facilitate laboratory building projects or is a company that installs laboratory furniture and related equipment manufactured by others. All sustaining members must establish that they sell or install at least one (1) product made by a SEFA Executive Member that has been successfully tested to at least one (1) of the SEFA Recommended Practices.

2. Applicant must have successfully completed at least ten (10) laboratory furniture projects within three (3) years of submitting its application for Sustaining Membership.

3. Applicant must submit two (2) letters of reference - one from a supplier that applicant has a current business relationship with and one from an owner or an architect or lab planner that the applicant has worked with. In addition, applicant must provide the name of a SEFA Member in Good Standing who will support their application in writing.

(d) Associate Member:

Associate Members shall consist of architects, lab planners/consultants, facility managers and others as deemed appropriate by the Board.

Section 3.2 Election to Membership

(a) Application for membership in the Association shall be in writing on such forms as may be prescribed by the Board of Directors for that purpose, which shall request such relevant information consistent with these By-Laws. Election to membership in the Association shall be by a two-thirds vote of the Board of Directors of the Association.

(b) All members shall have full intention to attend SEFA meetings, web conferences, participate in the standards writing process to the best of their ability and dedicate the necessary time and energy to help support and increase SEFA’s reputation as the premier, global association fostering the use of “Laboratory Grade” furniture and equipment and insuring excellence in the planning, design and installation of laboratory projects.

(c) Every SEFA Member and applicant shall acknowledge annually that they have not and will not in the future violate the Code of Ethics and will be bound by the Code of Ethics Rules and Procedures.

Section 3.3 Right to Vote, Hold Office and Receive Membership Benefits

Each Executive Member shall be entitled to one vote. Representatives of Executive Members shall hold office in the Association. Each Executive Member shall designate in writing its official voting representative and an alternate. Votes in the general affairs of the Association shall be cast only by the officially designated representative of the Executive Member, or in his absence, by his designated alternate.
Section 3.4 Use and Display of SEFA Logos and Trademarks

Only members in good standing shall have the right and license to display or use SEFA logos, copyrighted materials, service marks, trademarks or other SEFA proprietary information. The manner in which such logos, copyrighted materials, service marks, trademarks and other information may be displayed or used shall be determined by the Board of Directors.

Article 4. Dues

Association dues for executive, sustaining and associate members shall be fixed from time-to-time by the Board of Directors, and shall be approved or ratified by a majority vote of the Executive Members of the Association present and entitled to vote at a meeting at which a quorum is present.

Association dues for members are an annual obligation and for Executive and Sustaining Members, shall be calculated on the aggregate sales volume, where appropriate, including both domestic and international volume, generated by the Executive or Sustaining Member in its most recently completed fiscal year. Such calculations shall include the relevant sales volume of each member, including its divisions, affiliates and subsidiaries. The Board of Directors shall determine the time or times that dues shall be payable by members, and may provide for the pro-ration of such dues.

Article 5. Government

Section 5.1 Officers

The officers of the Association shall be a Chairman, a Vice-Chairman, a Secretary/Treasurer and the Immediate Past Chair. All of the officers shall serve without compensation. Each officer shall be elected annually, if necessary, by a majority vote of the Executive Members present and entitled to vote at the Annual Meeting of the Association.

In the event of death, resignation, or incapacity to act of any officer or director of the Association, the vacancy so created shall be filled by the Board of Directors.

Section 5.2 Board of Directors

The management of the affairs of the Association shall be vested in the Board of Directors, which shall consist of the Chairman, the Vice-Chairman, the Secretary/Treasurer, the Immediate Past Chairman and five (5) other at large directors who shall be elected by a majority vote of the members present and entitled to vote at the annual meeting of the Association. The Board shall include one Advisory Board Member. Membership on SEFA’s Board is not transferable to any other Company representative or individual.

Section 5.3 Nomination to the Board of Directors

No later than sixty (60) days prior to the Annual Meeting, the Immediate Past Chair
of the Board shall commence consultations with the Strategic Goals Committee and any members expressing an interest in board service. After such consultations have been completed the Immediate Past Chair will submit a proposed slate of Officers and Directors. This proposed slate of Officers and Directors will be emailed to the members at least thirty (30) days prior to the Annual Meeting. Nominations for any such office or offices may also be made from the floor by any duly designated representative of an Executive Member at the Annual Meeting of the Association.

Section 5.4 Duration of Tenure

Officers and Directors shall be elected for a term of two (2) years and thereafter until a successor shall have been duly elected and qualified, provided that no board member shall serve more than four (4) consecutive two (2) year terms in office.

Section 5.5 Removal of Officers and Directors

Any officer or director may be removed for due cause by an affirmative vote of two-thirds of the Board of Directors. Failure to attend two out of four of the most recent Board Meetings may constitute due cause for removal.

Section 5.6 Duties of the Chairman

The Chairman shall preside at all meetings of the Association and the Board of Directors. He shall perform such duties as may be required or permitted by these By-Laws or as the Board of Directors may from time to time direct.

Section 5.7 Duties of the Vice Chairman

The Vice-Chairman shall preside at all meetings of the Association or of the Board of Directors in the absence of the Chairman. The Vice-Chairman shall also perform such other duties as the Chairman or the Board of Directors may from time to time direct.

Section 5.8 Duties of the Secretary/Treasurer

The Secretary/Treasurer shall keep the minutes of all Board meetings and shall have charge of all corporate files, including the minutes of the Association. He shall prepare and distribute appropriate minutes of each Association meeting. He shall perform such other duties as are common to the office.

The Secretary/Treasurer shall have charge of all securities and bank accounts, and shall have the authority to transfer funds as needed to meet the Association's operating expenses. He shall exercise surveillance over all investments of the Association. He shall report periodically to the membership on the financial condition of the Association.

With the approval of the Board of Directors, the Secretary/Treasurer may delegate certain of his responsibilities to such staff members as may be retained by the Association.
Section 5.9 Bonding of Officers

The Board of Directors, at its discretion, may bond any officer or employee with an adequate bond for the faithful performance of his duties.

Article 6. Committees

Section 6.1 Committees

At the annual meeting of the Association, each committee shall elect two representatives to serve as co-chairs of their respective committees for the ensuing year. All committees shall continue their functions until the next annual meeting of the Association. The Chairman of the Board may appoint such Special Committees as the occasion may require.

Article 7. Meetings

Section 7.1 Annual Meeting of the Association

(a) The Annual Meeting of the Members of the Association shall be held at such time and place as the Board of Directors may determine. Written or printed notice shall be emailed to each member not less than thirty (30) days before the date of the meeting.

(b) Whenever the Board of Directors by a majority vote of all of its voting members, at either a meeting or by letter ballot, shall determine for any reason it is not in the interest of the Association to hold the annual meeting, then no such meeting shall be required to be held. Under such circumstances the Board of Directors may, at its discretion, conduct by letter or email ballot such business as would normally be conducted at any annual meeting or meetings thus omitted.

Section 7.2 Special Meetings of the Association

The Secretary/Treasurer shall call a Special Meeting of the Association when so requested by a majority of the Board of Directors, or by written request of one third of the voting members of the Association. Electronic notice stating the place, day and hour of the special meeting, and the purposes for which it is called, shall be emailed to each member not less than thirty (30) days before the date of the meeting. No business other than that specified in the notice of the meeting shall be transacted at the Special Meeting.

Section 7.3 Quorum at the Meetings of the Association

A majority of the voting membership present at any meeting of the members of the Association shall constitute a quorum, and in case there shall be less than this number, the presiding officer may adjourn the meeting from time-to-time until a quorum be present.

Section 7.4 Voting by Members of the Association
Voting in the general affairs of the Association shall be confined to active executive members, with each such member being entitled to one vote through or by the duly designated voting representative. Proxies will not be allowed unless specifically authorized by the Board. Unless otherwise provided by these By-Laws, a majority of the votes entitled to be cast by members present at a meeting at which a quorum is present shall be required. Any action required or permitted to be taken at a meeting of the members may be taken without a meeting if consent in writing, setting forth the action so taken, is signed by all of the members entitled to vote with respect to the subject matter thereof.

Section 7.5 Quorum and Voting

A majority of the Board of Directors shall constitute a quorum for the transaction of business. Unless otherwise provided by these By-Laws or the Code of Ethics Rules and Procedures, the act of a majority of the Board of Directors present at a meeting at which a quorum is present shall be the act of the Board of Directors. Any action required or permitted to be taken by the Board of Directors at a meeting may be taken without a meeting if consent in writing, setting forth the action so taken, is signed by all of the Directors.

Section 7.6 Ratification

In the event that a quorum shall not be present at any duly called meeting of the members, the Board of Directors, or of any committee, the members present and entitled to vote at any such meeting may take such action as they may elect subject to subsequent ratification by a letter ballot of a majority of the members thereof or at a duly called subsequent meeting at which a quorum is present.

Article 8. Termination of Membership

Section 8.1 Non-Payment of Dues

The Board of Directors shall terminate the membership of any member of the Association for non-payment of dues.

Section 8.2 Resignation

Any member may resign at any time from the Association by written notice to the Executive Director, provided that all financial obligations payable to the Association shall have been fully discharged.

Section 8.3 Suspension or Expulsion

(a) A member who shall violate any provisions of these By-Laws, or who shall refuse or neglect to comply with any resolution of the Association or of the Board of Directors, may have his membership terminated by the Board of Directors; provided, however, that such member shall be given prior written notice of the contemplated action by the Board of Directors and the reason or reasons thereof, with the right to appear and be heard before the Board of Directors prior to the taking by the Board of Directors of any final action with respect to such termination of membership. Any such termination
of membership shall occur only by an affirmative vote of three-fourths of the members of the Board of Directors.

(b) **Code of Ethics** - All members shall acknowledge in writing by an authorized agent, that they will be bound by SEFA's Code of Ethics and the Rules and Procedures for the enforcement of the Code of Ethics. Violation of the Code of Ethics may result in the termination of membership or such other action as authorized by the Rules and Procedures.

**Section 8.4 Reinstatement of Membership**

Any application for reinstatement to membership of a former member shall be treated in accordance with the applicable provisions of Article “3” of these By-Laws. No such applicant shall be reinstated to the membership until he has discharged all past indebtedness to the Association.

**Article 9. Interest in Association Funds and Property**

Any member who shall resign, or whose membership in the Association shall have been terminated for any reason, shall immediately relinquish and forfeit all interest in any funds or other property belonging to the Association including the right to display in any manner SEFA logos, copyrighted materials, service marks, trademarks or other proprietary information.

**Article 10. Dissolution**

In the event that the Association shall be dissolved, its net assets remaining after provision for the payment of all of its debts and liabilities shall be distributed to such other organization or organizations having the same or similar purposes of this Association as the Board of Directors shall determine, subject to ratification by the membership of the Association.

**Article 11. Indemnification of Directors and Officers**

The Association shall indemnify and hold harmless each person who is now or shall hereafter serve as a director or officer of the Association, from and against any and all claims and liability, whether the same are settled or proceed to judgment, to which such person shall have become subject by reason of his having heretofore or hereafter been a director or officer of the Association, or by reason of any action alleged to have been heretofore or hereafter taken or omitted by him as such director or officer, and shall reimburse each such person for all legal and other expenses (including the cost of settlement) reasonably incurred by him in connection with any such claim, liability, suit, action or proceeding; provided, however, that no such person shall be indemnified against, or be reimbursed for, any claims, liabilities, costs or expenses incurred in connection with any claim or liability, or threat or prospect thereof, based upon or arising out of his own willful misconduct in the performance of his duties as such director or officer. The determination hereunder and the reasonableness of such costs and expenses may be made, and shall be final and conclusive if made, by the Board of Directors of the Association acting at a meeting at which a quorum is present.
All such rights accruing to any person under the provisions of this paragraph shall not exclude any other right to which he may be lawfully entitled, nor shall anything herein contained restrict the right of the Association to indemnify or reimburse such person in any case even though not specifically herein provided for.

**Article 12. Rules and Regulations**

The Board of Directors may adopt or amend rules and regulations to carry these By-Laws into effect and to provide for the executive management of the Association, provided that the same shall not be inconsistent with the provisions and requirements of these By-Laws.

**Article 13. Amendments**

These By-Laws may be amended at any properly held meeting of the members of the Association by a vote of three-fourths of the executive members present and voting, provided that in case of a special meeting due notice of the purport of the proposed amendment shall be contained in the notice of the meeting or any adjournment thereof.

**SEFA Meetings Policy Statement**

SEFA meetings are gatherings of members at which the Association's business is transacted, and represent the opportunity to legitimately further the Association's goals. SEFA meetings are carefully structured and monitored. An agenda is prepared and circulated in advance and is carefully followed at the meeting. A SEFA staff member or legal counsel attends all meetings. There are no informal meetings of the Association or of any of its committees; discussion of SEFA matters must never occur outside of formal meetings.

There should never be a discussion of any of the following at a SEFA meeting:

1. Price or any elements of price or pricing policies, including costs.
2. Discounts, terms and conditions of sale, warranty terms, profits, market shares, sales territories, and rejection or termination of customers.
3. Identification of individual company statistics, inventories or merchandising methods.
4. Particular competitors.
5. Anything dealing with trade abuses or excluding or controlling competition.

By following these guidelines the members can meet to transact lawful Association business for the betterment of our industries.
SEFA-Approved Product Testing Facilities

Any company that would like to have their products tested “compliant” to SEFA’s Recommended Practices should contact one of the following SEFA-approved Independent Third Party Test Labs. These facilities are not SEFA Members but rather “SEFA approved” independent third-party labs which have demonstrated the necessary competence to perform testing to SEFA’s Recommended Practices.

For the most up-to-date list of approved Test Facilities visit us at sefalabs.com.

bb7
5407 Fen Oak Court
Madison, WI  53718
Tel:  (608) 224-0377
www.bb7.com

Cardinal Environmental
3303 Paine Avenue
Sheboygan, WI  53081
Tel:  (920) 459-2500
www.cardinalenvironmental.com

Gaynes Labs, Inc.,
9708 Industrial Drive
Bridgeview, IL  60455
Tel:  (708) 233-6655
www.gaynestesting.com

Instituto di Ricerche
Via Moscova 11, 20017
Rho (MI) Italy
Tel:  +39 02 9301517
www.istitutomasini.com

Micom Laboratories, Inc.,
556 rue Lepine
Quebec, Canada H9P 2V6
Tel:  (514) 633-0078
www.micomlab.com

TÜV SÜD Asia PSB Pte., Ltd.
1 Science Park Drive
Singapore 118221
Tel:  +65 6885 1335
www.tuv-sud-psb.sg

Bureau Veritas
Via Miramare, 15
Milano 20126 Italy
Tel:  +39 02 270911
www.bureauveritas.it

Exova
2395 Speakman Drive
Mississauga, Ontario L5K 1B3
Tel:  (905) 822-4111
www.exova.com

IMR Test Labs
131 Woodsedge Drive
(Lansing Technology Park)
Lansing, NY  14882
Tel:  (607) 533-7000 - www.imrtest.com

Intertek
4700 Broadmoor SE, Suite 200
Grand Rapids, MI  49512
Tel:  (616) 656-1166
www.intertek-etlsemko.com

SGS Testing Co.
1/F 3rd Building
No. 889, Yishan Road,
Xuhui District, Shanghai, China  200233
Tel:  86 (0)21 6140 2666 ext 2710 or 2068
www.cn.sgs.com

UL
3480 Windquest Drive
Holland, MI  49424
Tel:  (201) 258-0048
www.ul.com
SEFA Code of Ethics
and Code of Ethics Rules and Procedures
SEFA CODE OF ETHICS
(As Amended February 12, 2013)

SEFA members shall distinguish themselves by always engaging in honest, ethical and professional business practices. Membership shall be used as a means of professional development. Unfair, misleading, unethical or deceptive business practices are unacceptable and violate the Code of Ethics.

SEFA Code of Ethics:

1. SEFA members shall have, as their primary goal, developing and producing safe and functional laboratory furniture and equipment.

2. SEFA members shall yearly, in writing, acknowledge that they endorse the quality and performance levels stated in the recommended practices and that they will adhere to the Code of Ethics and be bound by the Rules and Procedures governing Code of Ethics Complaints.

3. SEFA members shall maintain objective, professional and ethical judgment. They shall not compromise that judgment by undertaking any activity, accepting any contribution or having any conflict of interest that would prevent acting in the best interest of their employers or clients.

4. SEFA members shall use their membership as a means of professional development.

5. SEFA members shall not intentionally engage in any unfair, misleading or deceptive trade practices under New York or United States Federal law.

6. SEFA members shall practice in a manner that supports the rights of employers, employees and clients, and shall not discriminate in any way.

7. Violation of the Code of Ethics may result in termination of membership or such other sanction as deemed appropriate by SEFA’s Board of Directors and consistent with the Code of Ethics Rules and Procedures.

8. Applicants for SEFA membership must adhere to SEFA’s Code of Ethics, as a condition of their application. Previous Code of Ethics violations by an applicant may disqualify the applicant from becoming a SEFA member.
As a condition of SEFA membership, all members shall follow these rules and procedures:

**Article I
COMPLAINT AND ANSWER**

§ 1.1 A SEFA member in good standing or the Code of Ethics Committee may file a written confidential complaint alleging a Code of Ethics violation by a SEFA member. The Company bringing the complaint must be a Member of SEFA for at least 18 consecutive months immediately preceding the filing of the complaint and must maintain its status as an active member in good standing during the period the complaint is pending.

§ 1.2 A filing fee is not required if the complaint is filed by the Code of Ethics Committee.

§ 1.3 Each complaint shall be accompanied by a non-refundable $850.00 filing fee.

§ 1.4 Robert's Rules of Order shall be followed in connection with all discussions and deliberations concerning Code of Ethics complaints.

§ 1.5 All Board members are required to participate in deliberations and vote on a complaint, unless they are either the complainant, the respondent or have some other conflict of interest.

§ 1.6 For purposes of these Rules and Procedures, the term “days” refers to “calendar days”.

§ 1.7 In all preliminary decisions made by the Board concerning a potential Code of Ethics violation, the Board shall vote on such matters and a simple majority of those voting shall be required for these determinations.

§ 1.8 A two-thirds majority of the Board voting shall be required to find a Code of Ethics violation and the corresponding sanction.

§ 1.9 The alleged Code of Ethics violation must involve business activities which establish qualification for membership in SEFA, as set forth in §3.2 of SEFA's By-Laws, and must have been committed within two (2) years of the complaint being filed. In the event a legal, administrative or arbitration proceeding is commenced and involves the same issues, then all proceedings under these Rules will be stayed pending final determination in the other forum.

§ 1.10 The complaint shall be filed with the Executive Director.

§ 1.11 Within fifteen (15) days of receipt of a Code of Ethics complaint, the Executive Director will communicate with the member or Code of Ethics Committee to obtain any additional information deemed relevant. This member or the Committee will provide this additional information within (15) days of receipt of the request.
§ 1.12 Upon receipt of all information provided by the complainant the Executive Director shall, within five (5) days, submit the confidential Code of Ethics complaint to SEFA's Board of Directors. The complaint shall remain confidential.

§ 1.13 Within thirty (30) days of the Board’s receipt of a complaint, the Board shall convene either in person or telephonically, to review the complaint.

§ 1.14 If the Board determines that it requires additional information from the complainant, it shall submit that information in writing within fifteen (15) days after receipt of such request. Alternatively, The Board may determine that it requires a confidential interview with the complainant as well as additional information.

§ 1.15 Within thirty (30) days after receipt of all information from the complainant and/or completion of an interview of complainant, the Board shall determine if there is probable cause to believe a violation has occurred. Probable cause is defined as a reasonable belief that a member has violated SEFA's Code of Ethics.

§ 1.16 A Board determination of no probable cause is final and may not be appealed.

§ 1.17 If the Board determines that there is probable cause to believe that a Code of Ethics violation has occurred then the Executive Director shall contact the member who is the subject of the complaint, so that said member has an opportunity to submit a response to the Code of Ethics complaint.

§ 1.18 The member who has been accused of a Code of Ethics violation shall submit an initial response to the complaint to the Executive Director within thirty (30) days of receipt of the Board’s probable cause determination.

§ 1.19 In the event the member fails to respond to the complaint, the Code of Ethics complaint will be deemed admitted and the Board shall, within thirty (30) days of said default, determine the appropriate sanction set forth in Article III below.

§ 1.20 Within fifteen (15) days of receipt of the response, the Executive Director shall request any additional information deemed necessary. The member shall provide said additional information to the Executive Director within fifteen (15) days of said request or such time as deemed appropriate by the Executive Director.

§ 1.21 Upon receipt of the full response or the expiration of the time permitted for such response, whichever shall occur first, the Executive Director shall promptly submit the member’s response to SEFA's Board of Directors.

§ 1.22 The Board shall reconvene, either in person or telephonically, within thirty (30) days after the time permitted to submit all responses.

Article II
CODE OF ETHICS DETERMINATION

§ 2.1 The Board may determine that it requires additional information from either party to make a determination. In such case, the party shall submit the additional information within fifteen (15) days after receipt of such request. The Board may also require an interview of the parties.
§ 2.2 In the event that the Code of Ethics violation involves a member of SEFA’s Board of Directors, said Board Member shall not participate, in any manner, in the determination of the Code of Ethics violation.

§ 2.3 Within thirty (30) days after receipt of all information, the Board of Directors shall determine if there exists clear and convincing proof that a member has engaged in a Code of Ethics violation and the appropriate sanction. Clear and convincing proof is defined as information which makes it highly probable that a Code of Ethics violation has occurred.

§ 2.4 All votes taken by the Board of Directors shall reflect only the number of votes cast. An abstention is not considered a vote for purposes of determining a simple majority or two-thirds (2/3) majority under §1.7 or §1.8 above.

Article III
SANCTIONS

§ 3.1 In the event that the Board of Directors determines that a Code of Ethics violation has occurred, the Board shall also determine the appropriate sanction for said violation. Those sanctions shall include an award of $850.00 to the member who filed the complaint and one of the following other sanctions:

a) The issuance of a private reprimand to the member;

b) The issuance of a public reprimand, which would involve a communication to the entire SEFA membership and a website posting that would be accessible to anyone visiting the SEFA website;

c) The member shall be placed on probation for a period not to exceed one (1) year, with appropriate conditions for such probation.

d) A suspension of SEFA membership for a period of time not to exceed five (5) years; or

e) Termination of SEFA membership.

§ 3.2 The severity of the sanction shall be based upon, among other factors, the following:

a) The damage caused by the violation or the benefit accruing to the member;

b) The length of time and/or number of times such violation(s) occurred;

c) Any prior warnings by anyone that such conduct was considered a violation of SEFA’s Code of Ethics or was otherwise unlawful;

d) The prompt acknowledgement of the violation by the member and a corresponding promise not to engage in such conduct in the future; and

e) Any other circumstances deemed relevant by the Board of Directors.
§ 3.3 Within seven (7) days of the Board making its determination, the Executive Director shall convey in writing said determination to the parties involved.

§ 3.4 The sanction shall take effect thirty (30) days after the member receives notice of the sanction.

§ 3.5 To the fullest extent allowed by law, the Board shall be fully indemnified, defended and held harmless by the complainant, respondent and SEFA in connection with the Board’s decisions and activities involving the complaint.

Article IV
APPEAL

§ 4.1 In the event that respondent disputes the determination of the Board of Directors that a Code of Ethics violation occurred, said SEFA member shall have the right to appeal the Board’s decision to the International Center for Dispute Resolution ("ICDR") of the American Arbitration Association ("AAA") located in New York, New York. Only the complainant and the respondent shall be parties to said AAA proceeding.

§ 4.2 The respondent forfeits its right to appeal if the complaint was deemed admitted by the member for failure to submit a response as required under these rules and procedures and shall have no recourse whatsoever to the AAA, any court of law, SEFA’s Board of Directors or any other SEFA committee or member.

§ 4.3 The Appeal to the AAA must be filed and all fees paid by the Company taking the appeal, in accordance with the rules of the AAA. The appeal must be filed within thirty (30) days after the SEFA member receives the Board’s determination that a Code of Ethics violation has occurred. The sanction imposed shall then automatically be stayed for one-hundred and twenty (120) days after the timely filing of the appeal.

§ 4.4 The appeal of such determination that a Code of Ethics violation was established by clear and convincing evidence, shall follow the rules of the American Arbitration Association and shall be determined by a panel of three (3) arbitrators, who shall make a decision within one hundred and twenty (120) days after the appeal is filed as to whether the Board of Director’s determination was supported by clear and convincing proof. The sanction imposed by the Board is not appealable and shall not be the subject of any determination in the arbitration proceeding. Notwithstanding the rules of the AAA the respondent in the SEFA Code of Ethics proceeding shall be responsible to pay all fees, costs and expenses of the arbitrators.

§ 4.5 The arbitrators are not authorized to make any other determinations other than to determine if the Board’s decision was supported by clear and convincing evidence.

§ 4.6 Notwithstanding §4.5, the arbitrators may award costs and reasonable legal fees to the complainant in the SEFA Code of Ethics proceeding in the event the Code of Ethics determination is upheld or affirmed by a majority of the arbitrators.
Question:

Can a SEFA Executive Member be found to have violated SEFA’s Code of Ethics when the conduct in question was performed by the Member’s dealer or installer?

Opinion:

The conduct of SEFA Members is governed by SEFA’s Code of Ethics as adopted in September 2010. In many instances, the SEFA Member may not be directly involved in the delivery and installation of the laboratory furniture and related equipment. Typically, this work is performed by companies or individuals designated by SEFA Members to act as dealers or installers. The Members may become aware that dealers and installers have engaged in conduct that might be considered a violation of SEFA’s Code of Ethics.

It is the opinion of the Board of Directors that under certain circumstances, a SEFA Member may be held accountable for ethical violations of its dealers and/or installers. Factors to be considered in making this finding include, but are not limited to, the participation of a SEFA Member in the unethical conduct; the extent of the SEFA Member’s knowledge of the unethical conduct engaged in by its dealer or installer; and whether the SEFA Member was advised by third parties (architects, lab planners, end-users, etc.) that they believed conduct may occur which could be deemed a violation of SEFA’s Code of Ethics.

In conclusion, the issue of whether a SEFA Member can be held accountable for the acts of its dealers or installers will have to be determined on a case-by-case basis after an analysis of all relevant factors.
Code of Ethics Confidential Complaint Form

STATE OF ___________________________

COUNTY/PROVINCE OF ______________ : SS.: 

COUNTRY OF _________________________

_________________________, being duly sworn deposes and says:

I am an active SEFA Member in Good Standing for the past 18 months and as such, I am eligible to make this complaint. I am the _______________ of ____________________________, hereinafter called the “complainant.” I make this Code of Ethics complaint against ____________________________, (Name of Company) hereinafter called the “respondent.” The incident/occurrence took place on ___________.

Date

Statement of alleged Code of Ethics violation: ____________________________________________

________________________________________________________________________________

________________________________________________________________________________

________________________________________________________________________________

Sworn to before me this Day of ___________, 20__

_________________________ Signature

____________________________________ Notary/Public

(Rev 20013)
Scientific Equipment and Furniture Association
65 Hilton Avenue · Garden City, NY 11530
Tel: 516-294-5424 · Fax: 516-294-2758 · Website: www.sefalabs.com
E-mail: info@sefalabs.com

Annual Certification

Company Name ____________________________

Mailing Address ____________________________

Physical Location Address __________________

City __________________ State/Province __________ Country __________ Postal Code __________

Phone __________________ Fax __________________ Email __________________

URL: www: __________________ Year Founded ______ Products Country of Origin __________

PRIMARY CONTACT:

Name: __________________

Address: __________________

City/State/PostalCode: __________________

Phone: __________________ Fax: __________________ Email: __________________

ADDITIONAL CONTACTS:

2) Name: __________________

Phone: __________________ Fax: __________________ Email: __________________

3) Name: __________________

Phone: __________________ Fax: __________________ Email: __________________

4) Name: __________________

Phone: __________________ Fax: __________________ Email: __________________

I certify that my company meets all the criteria for membership as set forth in the By-Laws of the Association. We agree to be bound by the most current version of SEFA’s Code of Ethics and the Rules and Procedures for the Enforcement of the Code of Ethics including the arbitration appeal process contained therein.

I further certify that the above is correct and that my company qualifies for membership under the current SEFA By-Laws. I acknowledge the “SEFA Recommended Practices” and agree to use the SEFA mark and related materials in accordance with the Association’s guidelines and to discontinue its use if no longer a current member in good standing. I acknowledge that misrepresentation of the above information is a basis for termination.

__________________________________________  ______________________________________
Signature                             Title

__________________________________________  ______________________________________
Printed Name                          Date

(12/2013)
## Table of Contents

<table>
<thead>
<tr>
<th>Committee Members</th>
<th>Page 49</th>
</tr>
</thead>
<tbody>
<tr>
<td>Foreword</td>
<td>Page 50</td>
</tr>
<tr>
<td>1.0 Purpose</td>
<td>Page 51</td>
</tr>
<tr>
<td>2.0 Scope</td>
<td>Page 51</td>
</tr>
<tr>
<td>3.0 Laboratory Fume Hood Defined</td>
<td>Page 51</td>
</tr>
<tr>
<td>3.1 Family of Ventilated Laboratory Safety Devices</td>
<td></td>
</tr>
<tr>
<td>3.2 ASHRAE-110 Protocol</td>
<td></td>
</tr>
<tr>
<td>4.0 Laboratory Fume Hood As Manufactured</td>
<td>Page 54</td>
</tr>
<tr>
<td>4.1 Components of Laboratory Fume Hoods</td>
<td></td>
</tr>
<tr>
<td>4.1.1 Hood Exterior</td>
<td></td>
</tr>
<tr>
<td>4.1.2 Hood Interior</td>
<td></td>
</tr>
<tr>
<td>4.1.3 Hood Baffle</td>
<td></td>
</tr>
<tr>
<td>4.1.4 Hood Exhaust Collar</td>
<td></td>
</tr>
<tr>
<td>4.1.5 Hood Bypass</td>
<td></td>
</tr>
<tr>
<td>4.1.6 Hood Sash</td>
<td></td>
</tr>
<tr>
<td>4.1.7 Hood Work Surface</td>
<td></td>
</tr>
<tr>
<td>4.1.8 Hood Lights</td>
<td></td>
</tr>
<tr>
<td>4.1.9 Hood Services</td>
<td></td>
</tr>
<tr>
<td>4.1.10 Hood Monitor</td>
<td></td>
</tr>
<tr>
<td>4.2 Types of Laboratory Fume Hoods</td>
<td></td>
</tr>
<tr>
<td>4.2.1 Bench-Top Fume Hood</td>
<td></td>
</tr>
<tr>
<td>4.2.2 Radioisotope Fume Hood</td>
<td></td>
</tr>
<tr>
<td>4.2.3 Perchloric Acid Fume Hood</td>
<td></td>
</tr>
<tr>
<td>4.2.4 Distillation Fume Hood</td>
<td></td>
</tr>
<tr>
<td>4.2.5 Floor Mounted Fume Hood (Walk-in Fume Hood)</td>
<td></td>
</tr>
<tr>
<td>4.2.6 Auxiliary Air Fume Hood</td>
<td></td>
</tr>
<tr>
<td>4.3 Energy Efficient Fume Hood</td>
<td></td>
</tr>
<tr>
<td>4.4 Testing of Laboratory Fume Hoods-As Manufactured</td>
<td></td>
</tr>
<tr>
<td>4.4.1 Face Velocity</td>
<td></td>
</tr>
<tr>
<td>4.4.2 Containment Testing - As Manufactured</td>
<td></td>
</tr>
<tr>
<td>4.4.3 Static Pressure - Bench Mounted Fume Hood</td>
<td></td>
</tr>
<tr>
<td>5.0 Laboratory Fume Hood As Installed</td>
<td>Page 63</td>
</tr>
<tr>
<td>5.1 Location in Laboratory</td>
<td></td>
</tr>
<tr>
<td>5.2 Safety Considerations</td>
<td></td>
</tr>
<tr>
<td>5.3 Fume Hood Evaluation in the Field - As Installed</td>
<td></td>
</tr>
<tr>
<td>5.3.1 Room Conditions</td>
<td></td>
</tr>
<tr>
<td>5.3.2 Sash Operations</td>
<td></td>
</tr>
<tr>
<td>5.3.3 Evaluation of Low Airflow Monitor</td>
<td></td>
</tr>
<tr>
<td>5.3.4 Face Velocity</td>
<td></td>
</tr>
<tr>
<td>5.3.5 Containment Testing - As Installed</td>
<td></td>
</tr>
<tr>
<td>5.4 Trouble Shooting</td>
<td></td>
</tr>
<tr>
<td>5.4.1 Insufficient Airflow</td>
<td></td>
</tr>
<tr>
<td>5.4.2 Room Cross Drafts</td>
<td></td>
</tr>
<tr>
<td>5.4.3 Exhaust Unit and Duct Considerations</td>
<td></td>
</tr>
<tr>
<td>5.4.4 Make-up Air</td>
<td></td>
</tr>
<tr>
<td>5.4.5 Laboratory Fume Hood Inspection and Maintenance</td>
<td></td>
</tr>
<tr>
<td>5.5 Maintenance</td>
<td></td>
</tr>
<tr>
<td>6.0 Laboratory Fume Hoods - As Used</td>
<td>Page 67</td>
</tr>
<tr>
<td>6.1 Safe Work Practices</td>
<td></td>
</tr>
<tr>
<td>6.2 Plan For Conducting Experiments</td>
<td></td>
</tr>
<tr>
<td>6.3 Wear Appropriate Personal Protection</td>
<td></td>
</tr>
<tr>
<td>6.4 Fume Hood Evaluation - As Used</td>
<td></td>
</tr>
</tbody>
</table>
### 6.5 Utilize Proper Work Practices
- **6.5.1** Proper Location of Equipment and Apparatus
- **6.5.2** Desired Operator Position and Movements
- **6.5.3** Proper Configuration of Vertical and Horizontal Sliding Sashes
- **6.5.4** Reduce Pedestrian Traffic Near the Hood
- **6.5.5** Ensure Hoods Are Cleaned and Decontaminated
- **6.5.6** Do Not Store Materials in the Hood
- **6.5.7** Summary of Proper Work Practices

### 6.6 Responsibilities for Ensuring Proper Hood Performance
- **6.6.1** Management
- **6.6.2** Principal Research Investigators
- **6.6.3** Health and Safety
- **6.6.4** Laboratory Design Team and Engineering
- **6.6.5** Construction Team
- **6.6.6** Controls Manufacturer
- **6.6.7** Building System Commissioning
- **6.6.8** Operation and Maintenance
- **6.6.9** Laboratory Personnel and Hood Users
- **6.6.10** Hood Manufacturers

### 8.1 Special Purpose Hoods
- **8.1.1** Demonstration Hood
- **8.1.2** California Hood
- **8.1.3** Ventilated Hoods and Enclosures
  - **8.1.3.1** Oversized Hood
  - **8.1.3.2** Table Top Hood
  - **8.1.3.3** Conventional Hood
  - **8.1.3.4** Balance Enclosure
  - **8.1.3.5** Microscope Enclosure
  - **8.1.3.6** Robotic Enclosure
  - **8.1.3.7** Histopathological Enclosures

### 8.2 Local Exhaust Ventilation
- **8.2.1** Canopy Hood
- **8.2.2** Slot Hood
- **8.2.3** Snorkel
- **8.2.4** Exhausted Laminar Flow Hoods

### 8.3 Exhausted Laminar Flow Hoods
- **8.4** Biological Safety Cabinets
  - **8.4.1** Class I Cabinets
  - **8.4.2** Class II Cabinets
  - **8.4.3** Class III Cabinets

### 8.5 Ductless Hoods

### 9.0 Terms and Definitions

### 10.0 Basic Calculations

### 11.0 Relevant Organizations

### 12.0 Regulatory and Industry Consensus Standards
- **12.1** (ACGIH) American Conference of Government Industrial Hygienists
- **12.2** ANSI/AIHA Z9.5-1992
- **12.3** ANSI/ASHRAE 110-1995
- **12.4** ASHRAE Handbook Applications 1999
- **12.5** NFPA 45, 2000
- **12.6** OSHA 1910.1450
- **12.7** Prudent Practices
- **12.8** Handbook of Laboratory Safety
SEFA 1 - Committee Members

Co-Chairs

Robert Deluca, LabCrafters, Inc.,
Javier Arguedas, Waldner Laboreinrichtungen, GmbH

Air Control, Inc.
Air Master Systems
Bedcolab
BSA Life Structures
Dalton
Flad Architects
HEMCO Corporation
Institutional Casework
Inter Dyne Systems, Inc.
Kewaunee Scientific Corporation
Labconco Corporation
Sheldon Laboratory Systems, Inc.
TFI Inline Design Corporation
Ultra Labs, LLC.
Foreword

SEFA Profile

The Scientific Equipment and Furniture Association (SEFA) is an international trade association comprised of manufacturers of laboratory furniture, casework, fume hoods and members of the design and installation professions. The Association was founded to promote this rapidly expanding industry and improve the quality, safety and timely completion of laboratory facilities in accordance with customer requirements.

SEFA Recommended Practices

SEFA and its committees are active in the development and promotion of Recommended Practices having domestic and international applications. Recommended Practices are developed by the association taking into account the work of other standard writing organizations. Liaison is also maintained with government agencies in the development of the specifications.

SEFA's Recommended Practices are developed in and for the public interest. These practices are designed to promote a better understanding between designers, architects, manufacturers, purchasers, and end-users and to assist the purchaser in selecting and specifying the proper product to meet the user's particular needs. SEFA's Recommended Practices are periodically updated. The Recommended Practices are numbered to include an annual suffix which reflects the year that they were updated. SEFA encourages architects to specify these Recommended Practices as follows: “SEFA 1-2010”.

Glossary of Terms

SEFA has developed a Glossary of Terms (SEFA 4-2010) for the purpose of promoting a greater understanding between designers, architects, manufacturers, purchasers and end users. The terms defined by SEFA are frequently used in contracts and other documents, which attempt to define the products to be furnished or the work involved. The Association has approved this Glossary in an effort to provide uniformity among those who use these terms. Where a specific Recommended Practice contains definitions which differ from those in the Glossary of Terms, then the definitions in the specific Recommended Practice should be used.

SEFA encourages all interested parties to submit additional terms or to suggest any changes to those terms already defined by the Association. The definitions should be used to help resolve any disputes that may arise or to incorporate the applicable terms in any contract or related documents.

SEFA Disclaimer

SEFA uses its best effort to promulgate Recommended Practices for the benefit of the public in light of available information and accepted industry practices. SEFA does not guarantee, certify, or assure the safety or performance of any products, components, or systems tested, installed, or operated in accordance with SEFA Recommended Practices or that any tests conducted under its Recommended Practices will be non-hazardous or free from risk. SEFA encourages the use of third party independent testing.

Note: Testing as described in this document must be performed and documented by a SEFA-approved third party testing facility. See Page 34 of the SEFA Desk Reference 5th Edition Version 2.0, or visit us at SEFALABS.COM for the most current list of SEFA-approved test labs.
1.0 Purpose

The purpose of these Recommended Practices is to provide architects, engineers, planners, specifiers, manufacturers and end users with the Industry Standard Practices. These Recommended Practices cover the design, construction, installation, testing, maintenance and safe use of laboratory fume hoods.

2.0 Scope

These Recommended Practices provide a comprehensive single source of knowledge pertaining to laboratory fume hoods. Since the laboratory fume hood is integral to the Laboratory Ventilation System, these practices will address the entire system as it relates to the laboratory fume hood.

A Laboratory Ventilation System includes the Supply Air System; the Exhaust Air System (which includes room air exhaust in addition to the laboratory fume hood exhaust); the Laboratory; the Laboratory Fume Hood, and other ventilated enclosures.

3.0 Laboratory Fume Hood Defined

A Laboratory Fume Hood is a safety device specifically designed to carry undesirable effluents (generated within the Hood during a laboratory procedure) away from laboratory personnel and out of the building, when connected to a properly designed laboratory ventilation system. A Laboratory Fume Hood shall be made primarily from flame resistant materials including the top, three fixed sides, and a single face opening. Face opening is equipped with a sash and sometimes an additional protective shield. Face opening will have a profiled entry and usually an airfoil designed to sweep and reduce reverse airflows on the lower surface. A Laboratory Fume Hood will be equipped with a baffle and, in most cases, a bypass system designed to control airflow patterns within the hood and manage the even distribution of air at the opening. The bypass system may be partially blocked to accommodate Variable Air Volume (VAV) Systems. A Laboratory Fume Hood will be set on a bench, a pedestal or on the laboratory floor.

Fig. 1 Typical Constant Volume Laboratory Ventilation System
A Laboratory Fume Hood is given here as the proper terminology. Other widely used terms include --- Fume Hood, Chemical Hood, Chemical Fume Hood, Hood, and Fume Cupboard.

Laboratory fume hoods are perhaps the most widely used and misused safety devices. Fume hoods are available in many shapes, sizes, materials, and finishes. Their flexible design enables them to be configured to accommodate a variety of chemical procedures. However, the flexibility offered by different designs and operating configurations can result in varying levels of performance and operator protection. Great care must be employed by the user when using a laboratory fume hood. Consult the manufacturers’ Recommended Practices for Specific Operation, Safety and Maintenance Guidelines.

3.1 Family of Ventilated Laboratory Safety Devices

The laboratory fume hood is part of the ventilated laboratory safety device family and can be sub-categorized by type. (See Figure 2) Each type is connected to a laboratory ventilation system. These “other” systems are described in Section 8.0.

3.2 ASHRAE-110 Protocol

This practice is organized to be consistent with the ASHRAE 110 protocol. “As Manufactured” issues in this practice are directed to fume hood practices that are pertinent to the hood manufacturers’ location. “As Installed” identifies those that occur in a newly constructed or renovated laboratory prior to the user occupying the lab. The “As Used” section helps with issues after the installation is complete and how the hood is to be or is being used.
Types of Ventilated Devices

Laboratory Fume Hoods

- (4.2.1) Bench Top Hood
- (4.2.4) Distillation Hood
- (4.2.5) Floor Mounted Hood
- (4.2.6) Auxiliary Air Hood
- (4.2.2) Radiosotope Hood
- (4.2.3) Perchloric Acid Hood

Hazard: Chemical
Toxicity: Low to High
Volume Generation: Small to Large
Effluent: Gases, Vapors, Mists, Fumes, etc.

Hazard: Perchloric Acid Only
Volume Generation: Small to Moderate
Effluent: Gases, Vapors, Mists

Other Ventilated Laboratory Safety Devices

- (8.1.1) Demonstration Hood
- (8.1.2) California Hood
- (8.1.3) Ventilated Enclosure

Local Exhaust Ventilation

- (9.2.1) Canopy Hood
- (9.2.2) Slot Hood
- (9.2.3) Stantted Elephant Trunk

Hazard: Chemical
Toxicity: None to Low
Volume Generation: Small
Effluent: Gases, Vapors, Particulate, Powder

Must be specifically designed for process

Laminar Flow Hoods

- (8.3) Class I Weighing Enclosure

Biological Safety Cabinets

- (8.4.1) Class I Cabinets
- (8.4.2) Class II Type A1 Cabinets
- (8.4.2) Class II Type A2 Cabinets
- (8.4.2) Class II Type B1 Cabinets
- (8.4.2) Class II Type B2 Cabinets
- (8.4.2) Total Exhaust

Hazard: Chemical
Toxicity: Low to High
Volume Generation: Small to Large
Effluent: Particulate, Powder

Hazard: Biological
Toxicity: Low to High
Volume Generation: Small
Effluent: Particulate, Powder

Class II Type B2
Limited Use with Gases, Vapors, and Radionuclides

Hazard: Chemical, Biological, Radiological
Toxicity: Immediately Dangerous to Life and Health (IDLH)
Volume Generation: Small
Effluent: Gases, Vapors, Particulate, Powder

Glove Box Safety Cabinets

- (8.4.3) Class II Glove Box

Hazard: Chemical
Toxicity: None to Low
Volume Generation: Small
Effluent: Gases, Vapors, Particulate, Powder

Ductless Fume Hood
(Refer to SEFA 8-3010)

Fig. 2
4.0 Laboratory Fume Hood - As Manufactured

There are a wide variety of fume hood designs. Underwriter’s Laboratories (UL) Standard 1805 outlines requirements for the structural integrity, the flame and chemical resistance, the plumbing piping and electrical wiring of the fume hood structure. SEFA recommends the fume hood be classified under UL standard 1805. They generally share a number of similar characteristics and components. The hood depicted in Figure 3 below, shows generalized components of laboratory fume hoods.

4.1 Components of Laboratory Fume Hoods

4.1.1 Hood Exterior

The hood exterior is the external "skin" and is usually made of painted steel. Some hood exteriors are made of stainless steel, polypropylene, wood, or phenolic. The exterior front of the hood is an important design element for fume containment. Properly designed laboratory fume hoods will have a contoured entry, which assists airflow into the hood and could improve hood performance. The enclosure of the hood is designed to protect against chemical attack. However, if the exterior surfaces of your hoods exhibit corrosion or deterioration, investigate the source.

The airfoil sill is a radiused or angled air vane positioned on the leading edge of the work surface. The sill is designed to enable smooth flow over the work surface and provide a bypass opening when the sash is lowered or closed. Some flush sills employ a trough for spillage containment and slots to direct airflow over the work surface.

4.1.2 Hood Interior

Fume chamber and baffles shall be constructed of materials that are resistant to the chemical fumes, vapors and condensation particulate that may collect and deposit on the interior surface of the fume chamber and baffles. Consideration should be given to the desired color and specifications of liner materials that are resistant to the chemical exposure and corrosion resistance in the fume chamber. Typical liner materials are fiber reinforced thermoset composite – epoxy and polyester, phenolic resin, stainless steel type 304 and 316, thermoplastics – polyvinyl chloride, high density polyethylene, polypropylene and...
melamine, chemical resistant mineral board, and sheet steel. Liner materials should be flame retardant, self-extinguishing and have a flame spread rating of 25 or less in accordance with ASTM-E84.

If the fume hood liner is not rated at 25 or less in accordance with ASTM-E84 or there is a high risk potential of fire hazard in the fume chamber, for safety reasons the fume hood should be equipped with automatic fire suppression and alarm system or, in some cases, local jurisdiction may require fire suppression system, wet or dry.

4.1.3 Hood Baffle

The baffle in the rear of the hood interior is designed to control airflow distribution within the hood and through the face opening. The baffle slots are sometimes adjustable. The location, size, shape and configuration of baffle slots significantly affect the performance of the laboratory fume hood. (See: Knutson, Gerhard W. “Effect of Slot Position on Laboratory Fume Hood Performance”, Heating/Piping/Air conditioning Feb. 1984: 93-96).

4.1.4 Hood Exhaust Collar

The exhaust collar that connects the hood to the exhaust duct is located behind the baffle at the top of the interior liner. The collar should be made of a corrosion resistant material, or a material appropriate for the fume hood application. The design of the exhaust collar can affect the hood static pressure drop and noise level, e.g. “bell-mouth” duct collars can reduce the turbulence associated with the airflow transition from the hood chamber to the exhaust system ductwork.

The number of exhaust collars varies depending on the length of the hood. Typically hoods longer than six feet have more than one exhaust collar for connection to the exhaust ducts.

4.1.5 Hood Bypass

Open Bypass: On hoods equipped with a vertical rising sash, an open bypass is used to divert air from the face opening when the sash is lowered. Diverting air through the bypass redirects the volume of air entering the face of the hood and, thus, limits variation to the face velocity. Bypasses are generally designed to limit the increase in face velocity. The velocity, when measured at the sash opened six inches, shall be no more than three times the velocity at the sash fully opened. Limiting the increase in face velocity is important as excessive face velocity can cause significant turbulence within the hood and interfere with experiments and apparatus in the hood. This helps maintain a constant exhaust volume.

Restricted Bypass: The restricted bypass serves the same function as the open bypass, but the bypass is smaller. This is done to reduce the amount of air required by the laboratory fume hood in the operating mode for VAV systems, horizontal, and combination sashes. Eliminating the bypass completely is not recommended due to the potential risk of contaminate leakage.

Minimum exhaust volume is recommended at 25cfm per square foot of work surface. (See: latest edition of NFPA 45 Standard on Fire Protection for Laboratories Using Chemicals.)

4.1.6 Hood Sash

The sash is a moveable panel(s), most typically transparent, provided on fume hoods to restrict the opening and provide a protective barrier between the operator and the experiment. Sashes are available in a variety of configurations that enable vertical and/or horizontal movement of sash panels. Regardless of configuration, the sash shall be designed to move freely and not bind. Force to open the sash shall be reasonable for the size and weight of the sash.

Typically a five foot hood with a vertical rising sash shall require approximately five pounds of force to operate the sash. An additional one pound of force may be required for each additional linear foot of fume hood width.

Sashes are typically designed so that closing the sash does not restrict the area beneath the airfoil sill. This leaves the area beneath the airfoil open when the sash is fully closed.
Sash height limiting devices (also known as sash stops) are sometimes provided to limit the vertical opening of the sash. Sash stops are used to provide a safe operating condition based upon having limited available fume hood exhaust air volume. The opening at which the sash stop limits the sash opening is called the “operating sash opening” or the “design sash opening”. If the sash stop is defeatable, the sash can be opened to the “maximum sash opening” or the “load sash position”. ASHRAE 110 testing should be performed at both, the design opening and the maximum opening. If fume containment is unacceptable when the sash stop is bypassed, a warning label should be mounted on the fume hood clearly identifying the operating sash height and the potential dangers on bypassing the sash stop.

Sash types are generally referred to as vertical, horizontal or combination depending on the allowable movement of the sash panels. (See: Figure 4).

**Vertical Sash:** A vertical sash has one or more panels that can slide up and down to a height required by the operator. The sash controls the opening area and it is generally advisable to lower the sash below the breathing zone of the operator during generation of hazardous contaminants. Hoods may be equipped with sash stops to restrict the opening height of the sash. Vertical sashes may also be designed split into multiple vertical rising sashes.

**Horizontal Sash:** A horizontal sash has typically two or more panels that slide horizontally across the hood opening. The sash panels slide in tracks located at the top and bottom of the face opening. Horizontal sashes are used to restrict the maximum opening area of the face, but allow access to the top interior of the hood enclosure.

**Combination Sash:** A combination sash has horizontal sliding sash panels positioned in a vertically sliding sash frame. The combination sash provides the convenience of both vertical sash operation and horizontal sash operation.

Horizontal and combination sash panels should be used as a barrier from hazards within the hood. The sash panel should be placed between the operator and the hazard whenever feasible.
Telescoping Sash – Two or more vertically moving sash elements whose movements are linked.

4.1.7 Hood Work Surface

Work surfaces are typically made of a material that provides good heat and corrosion resistance and is easily cleaned and decontaminated. The work surface should have a recessed area. The dished or recessed area is designed to provide containment of small spills and provide demarcation of the recommended work area inside the hood. Refer to SEFA 3 – Recommended Practices for Work Surfaces.

4.1.8 Hood Lights

Most fume hoods are equipped with some type of light. Lights come in a variety of designs depending on the anticipated use of the hood. Most lights are fluorescent tubes housed outside the hood chamber and separated by a vapor resistant safety glass panel in the top of the hood. Access to re-lamping these types of lights should be from the hood exterior. The light shall be designed to provide a minimum of 80 foot candles on any part of the bench level (36” from the floor) work surface. Incandescent vapor proof lights as well as incandescent and fluorescent explosion proof lights are optional and available as specified. Many manufacturers offer electronic ballasts and energy efficient T8 or T5 bulbs.

4.1.9 Hood Services

Many hood manufacturers can equip hoods with a variety of amenities or services. The more popular services include electrical outlets, sinks, fixtures and plumbing for gas, vacuum, and air. For increased safety, controls for these services should always be accessible from outside the hood opening.

Service Fixtures: All service fixtures shall be installed so that service supply lines can be connected or disconnected, either by design of the piping assembly or through an access panel in the hood interior or exterior. All service valves shall be accessible for maintenance. All service fixture controls (e.g., gas, air, water, vacuum) should be external to the hood interior, clearly identified and within easy reach. All internal service fixture outlets shall be corrosion resistant to the application. (See SEFA 7—Recommended Practices for Laboratory Fixtures.)

Connections for services will vary, depending on the point of origin and number of fixtures. Service lines may be brought in from below, down from the ceiling, or from the back wall.

Typical piping requirements are as follows:

- Water – copper.
- Gas – wrought iron or steel (galvanized or black) or yellow brass (containing not more than 75% copper). (See: Uniform Building Code, 2000 Edition, International Association of Plumbing and Mechanical Officials, 20001 Walnut Drive, South Walnut, CA 91789 www.iapmo.org).
- Air – copper – black iron can be used as an alternate.
- Vacuum – copper – black iron can be used as an alternate.
- Specialty Gas – appropriate materials as specified.

NOTE: Check your regional or local codes for jurisdiction and material allowance. There are regional differences.

Electrical Receptacles: All electrical receptacles should be readily accessible. Provisions shall be made so that all electrical wiring will be isolated and physically separated from vapors handled within the hood interior after the fume hood is installed. The receptacle shall be installed with the ground outlet above the power slots. If electrical receptacles are within fume hood interior, they should be installed per NFPA and UL recommendations.


Flammable materials are used successfully in most hoods. In an extreme case, such as specifying
a laboratory fume hood for highly volatile, flammable, hazardous procedures and use (for a complete list, request NFPA - National Fire Protection Association Publication #497M), follow NEC codes. NEC divides materials into classes and groups according to the type of explosive agent that may be present. In addition, if there is a very high risk of fire, the fume hood should be equipped with a fire suppression system. Sufficient air volume must be exhausted through the hood to dilute flammable effluents below the lower explosive limit level. See NFPA 45 for more information on minimum recommended exhaust volumes. (See: NFPA 70 National Electrical Code, 2002 Edition, NFPA).

Fire Suppression Systems:

• Any fire suppression system used in a chemical fume hood should be compliant with local codes and regulations, and NFPA 17.

• Any fire suppression system should be rated for fire classes A, B, C with manual and thermal activation triggers. Other water or liquid based systems may be acceptable if appropriate testing and certification are available.

• No fire dampers of any kind should ever be installed in a chemical fume hood exhaust system.

• Flammable materials should never be stored directly below a chemical fume hood in anything but an NFPA specified, UL listed or FM approved solvent storage cabinet.

4.1.10 Hood Monitor

All hoods shall have some type of monitor for indicating face velocity or exhaust flow verification. The monitor can be a simple pressure gage connected to a Pitot tube in the exhaust duct, one of many electronic monitors, or a vaneometer. Regardless of the monitor installed, it should provide clear indication to the hood user whether exhaust flow or face velocity is within design parameters.

A ribbon taped to the bottom of the sash is not acceptable.

4.2 Types of Laboratory Fume Hoods

4.2.1 Bench-Top Fume Hoods

A bench-top fume hood is a hood that is generally placed on a bench-top or above a storage cabinet. Bench-top hoods are available in different sizes to accommodate a variety of chemical processes. The critical dimensions for a hood include length, depth and interior height; however, hood size is generally determined by the overall width of the hood. A five foot hood includes the width of the face and the side panels and is not a measure of the opening width. Side panels range in width from two to eight inches depending on the design and hood manufacturer.

Bench-top hoods can have vertical, horizontal or combination sash types and open or restricted bypasses depending on the sash type.

Bench-top hoods can be used for a wide variety of chemical procedures. The bench-top hood is appropriate for use with small to moderate quantities of low to highly toxic materials.

Depending on the materials of construction and operating configuration, this type of hood can provide effective containment, and exhaust of gases, vapor, mists, fumes and other aerosols having low particle mass.

4.2.2 Radioisotope Fume Hood

A fume hood used for Beta and Gamma radiation shall be referred to as a radioisotope hood. A radioisotope hood has the general characteristics of a bench-top fume hood except the work surface and interior lining must be type 304 stainless steel with coved seamless welded seams for easy cleaning and decontamination. The hood design is identical to other hood types in nearly all other respects. Horizontal sash panels are not appropriate for this fume hood type.

The work surface shall be dished to contain spills and cleaning liquids and shall be properly reinforced to support lead shielding and shielded containers. The load-bearing capacity shall be 200 pounds per square foot (90.71 Kg m2) minimum.
up to a total weight of 1,000 pounds (453.6 Kg) per fume hood or base cabinet section.

### 4.2.3 Perchloric Acid Fume Hood

A perchloric acid hood has the general characteristics of a bench-top hood; however, the interior lining must be coved and welded seamless stainless steel (other non-reactive material such as CPVC or polypropylene have been used when heat is not a concern). Non reactive and corrosion resistant material should extend all the way through the exhaust system.

In addition, the hood, duct, and fan must have a water wash down system to remove perchlorates and prevent the build-up of potentially explosive perchlorate salts. Drain outlet shall be designed to handle a minimum of 15 gallons (56.8 liters) per minute. The work surface on perchloric acid hoods typically has a water trough at the back of the hood interior under the baffle. The fume hood liner in a perchloric acid fume hood shall have no access holes such as those which may be used for plumbing access. Access panels should be considered in the lab layout for access through the hood exterior. In nearly all other respects, however, the design of perchloric acid hood is the same as conventional or bypass fume hoods.

A perchloric acid hood shall never be tied to a manifold system.

### 4.2.4 Distillation Fume Hood

A distillation fume hood is designed for use with tall apparatus and procedures that involve small to medium quantities of low to high toxicity materials. A distillation hood has the same components as a bench-top hood with the exception that the design provides a greater interior height. The hood is suitable for work that can be conducted in a bench-top hood; however, the greater interior height enables use of larger apparatus.
The distillation hood is mounted on a pedestal that elevates the work surface to a height between 12 and 18 inches above the floor.

Distillation hoods can have vertical rising sashes or horizontal sliding panels. Generally, more than one sash panel is used on a vertical rising sash. The vertical sash design generally enables a rather large opening and care must be taken in determining the maximum allowable sash opening and required exhaust flow to provide a safe operating condition and ensure effective fume containment.

4.2.5 Floor Mounted Fume Hood (Commonly known as a Walk-in Fume Hood)

A floor-mounted hood is used for large apparatus and storage of containers that pose some hazard, but will not fit into an approved storage cabinet. A floor-mounted hood is suitable for the same type of work conducted in bench-top hoods and distillation hoods.

Floor mounted hoods are typically equipped with horizontal sliding sashes, although some models...
are equipped with multiple vertical sliding sashes. Horizontal sashes are recommended on hoods over eight feet in width.

The name “walk-in hood” implies that the hood can be entered; however, the name is a misnomer, as the same safety precautions should be applied to this hood, as those required for a bench-top hood. The hood must never be entered during generation of hazardous materials or while concentrations exist within the enclosure. For this reason, we refer to these structures as floor mounted fume hoods.

Floor mounted hoods are particularly susceptible to variations in face velocity across the opening and room air disturbances due to the large opening area afforded by the hood design. For this reason, it is prudent not to use a floor mounted hood for work with highly toxic materials.

It is recommended that only one sash be fully opened during hood operation on floor mounted hoods with multiple vertical sashes. Both sashes are to be fully opened during set up only.

4.2.6 Auxiliary Air Fume Hood

The auxiliary air system, when added to a standard laboratory fume hood, shall function to reduce the consumption of conditioned room air. The auxiliary air is typically introduced exterior to the fume hood face and enters the fume hood through the face with the sash(es) open.

With the sash(es) closed, auxiliary air shall be drawn into the fume hood interior in such a manner as to aid in the dilution of heat and fumes generated in the work area.

NOTE: Consideration should be given to preconditioning and filtering auxiliary air.

Auxiliary air fume hoods shall also conform to the following requirements:

- Provide safe capture and efficient removal of fumes from the hood when operated at air ratios specified by the manufacturer.
- Capture the percentage of auxiliary air specified by the manufacturer when operated with the sash(es) open or closed.
- Capture, contain and carry away fumes generated in the work area when operated at a condition of imbalance between the auxiliary air and room air as specified by the manufactures.
- Function in accordance with the performance characteristics listed above when tested by appropriate evaluation procedures.
- Never pressurize the hood chamber with auxiliary air.

The manufacturer shall include auxiliary air static pressure data for all standard catalog models.

4.3 Energy Efficient Fume Hood

Energy efficient fume hood (also known as Low Exhaust Volume, or LEV fume hoods) designs can offer significant reductions in the volume of exhaust air required to safely operate the fume hood. Energy efficient hoods can be divided into two categories: Low Flow Fume Hoods and Low Velocity Fume Hoods.

- Low Flow Laboratory Fume Hoods are hood designs that provide a reduction in the required exhaust air volume, when compared to the volume required for the same size fume hood to operate with a face velocity of 100 FPM through a fully opened vertical sash, e.g: a typical 6’ wide bench mounted fume hood requires approximately 1100 CFM of exhaust flow to achieve an average face velocity of 100 FPM through a fully opened vertical sash. A 6’ wide hood operating at less than the volumetric exhaust flow would be classified as a Low Flow fume hood.

- Low Velocity Laboratory Fume Hoods are hood designs that provide a reduction in the required exhaust air volume, when compared to the volume required for the same size fume hood to operate with a face velocity of 100 FPM through a fully opened vertical sash and provides containment levels equivalent or superior to ASHRAE 110 tracer gas test ratings of 4.0 AM 0.05, and 4.0 AI/AU 0.10, with a face velocity of 60 FPM or less through the fully opened vertical sash. Low
Velocity Fume Hoods are also referred to as High Performance Fume Hoods and High Efficiency Fume Hoods.

NOTE: Low Flow hoods which achieve a reduction in volumetric flow by restricting the sash opening area do not qualify as Low Velocity or High Performance fume hoods unless they also meet the performance requirements listed above through the maximum sash opening. The “maximum sash opening” shall be considered a vertical sash opening not less than 25” high off the fume hood work surface.

Energy efficient fume hoods often feature new designs and features not found on traditional fume hoods, including redesigned bypass systems, new baffle configurations, low profile airfoil sills and aerodynamic sash frame designs. Some manufacturers offer unique electrical and mechanical "safety controls" which are integral to the superstructure of the energy efficient fume hood. These control systems often enhance the safety afforded to the fume hood operator during use. The maintenance of these safety control systems should be performed in accordance with the manufacturer’s guidelines to ensure safe and proper operation of the fume hood.

Energy efficient fume hoods are available in bench mounted, floor mounted, distillation and specialty hood types. Energy efficient fume hood designs are appropriate for almost all of the same applications as traditional fume hood designs. While energy efficient fume hoods can be integrated into any type of laboratory ventilation system, most often these style fume hoods are installed on Constant Air Volume (CAV) systems. However, these hoods can operate on Variable Air Volume (VAV) systems and Switched Two-State systems. The return-on-investment period should be evaluated when deciding which type of system to use.

It has been determined that there is no direct statistical correlation between a fume hood's average face velocity and the containment levels provided by the fume hood. (See: Hitchings, Dale T. "Laboratory Fume Hood Testing: Face Velocity Does NOT Equal Safety" Laboratory Safety & Environmental Management 3.6 (1995)).

On a properly designed fume hood, a lower face velocity can actually enhance fume hood performance through aerodynamic design and reduced turbulence. SEFA recommends the ANSI/ASHRAE 110 test to evaluate the performance of all laboratory fume hoods, including the energy efficient fume hoods. Currently, there are no special tests outlined in the ASHRAE standard for fume hoods operating at reduced exhaust flows. Energy efficient fume hood designs are tested to the same standard as traditional fume hood designs. However, the ASHRAE Standard allows for owners, engineers and/or architects to specify specific challenges to any fume hood design to investigate the fume hood’s ability to perform under less than ideal conditions. Tests have been performed with the hood chamber loaded with equipment and apparatus, thermal challenges within the fume hood chamber, cross drafts, walk-by traffic, etc.

4.4 Testing of Laboratory Fume Hoods - As Manufactured

The ASHRAE 110 test is a method of testing the performance of laboratory fume hoods. There are three test procedures incorporated into the 110 test: the first is the face velocity grid test, the second is the flow visualization or smoke test and the third is the tracer gas containment test. The ASHRAE 110 is the recognized method for evaluating the performance of fume hoods; ASHRAE has defined three modes, As Manufactured (AM), As Installed (AI), and As Used (AU). The ASHRAE test should be conducted by an authorized person cognizant of each of the three test procedures.

4.4.1 Face Velocity

Face velocity shall be adequate to provide containment. Face velocity is not a measure of safety.

Refer to ASHRAE 110 – 1995 (or latest edition) for velocity measurement procedures.

Face Velocity Guide –The most widely accepted range of average face velocities is 60 FPM to 100 FPM. The measured deviation across the face may vary + 20 FPM. (For more information on this topic,
refer to Section 12.0 Regulatory and Industry Consensus Standards.)

4.4.2 Containment Testing – As Manufactured

The manufacturer shall provide standard (AM) test data for all standard hoods. This should be done in accordance with the most current ASHRAE 110 Standard. The AM testing demonstrates what the hood is capable of doing under controlled conditions. The report shall verify that all laboratory fume hood types specified have been tested to ASHRAE 110-1995 (or most current edition) procedures and have achieved AM 0.05. AM 0.05 can be achieved with a properly designed laboratory fume hood. It shall not be implied that this exposure level is safe. Safe exposure levels are application specific and should be evaluated by properly trained personnel.

The ASHRAE 110 Standard includes procedures for:

Inspection of the Hood;
Evaluation of Laboratory Conditions;
Airflow Visualization;
Airflow Velocity Measurements; and
Tracer Gas Containment Tests.

4.4.3 Static Pressure - Bench Mounted Fume Hood


With sash at full-open position, static pressure loss through the fume hood shall be no more than ¼ inch (6.35 mm) of water gauge when the fume hood operates at face velocity of 60 feet per minute (.30 m/s), ½ inch (12.70 mm) of water gauge at 100 feet per minute (.51 m/s), ½ inch (12.70 mm) of water gauge at 120 feet per minute (.62 m/s). The manufacturer shall state the design static pressure loss for all standard catalog models. For all constant volume laboratory fume hoods equipped with a bypass, static pressure loss and exhaust volume shall be relatively constant regardless of sash position. The velocity when measured at the sash opened six inches, shall be no more than three times the velocity at the sash operating opening.

5.0 Laboratory Fume Hoods - As Installed

5.1 Location in Laboratory

Laboratory fume hood exhaust systems should be balanced with room exhaust systems and may be used in conjunction with room exhaust to provide the necessary room ventilation. Constant operation of a fume hood will also provide fume control during non-working hours. If the laboratory control system provides for proximity sensors at the fume hoods, reducing the face velocity through the open sash when users are not present at the fume hood face, fume control must still be maintained.

Laboratory fume hoods should be so located within the laboratory to avoid crosscurrents at the fume hood face due to heating, cooling or ventilating inlets.

Sufficient makeup air must be available within the laboratory to permit fume hoods to operate at their specified face velocities.

Other location factors to be considered are as follows:

Number and types of fume hoods in the laboratory space;
Location and number of ingress/egress aisles and/or laboratory space exterior doorways;
Frequency and/or volume of expected fume hood users;
Location of laboratory safety equipment.

5.2 Safety Considerations

Laboratory fume hoods are potential locations for fires and explosions due to the types of experiments conducted in these units. As
such, fume hoods should be located within the laboratory so that in the event of a fire or explosion within the fume hood, exit from the laboratory would not be impeded. Laboratory fume hoods should be located away from high traffic lanes within the laboratory because personnel walking past the sash opening may disrupt the flow of air into the unit and cause turbulence, drawing hazardous fumes into the laboratory.

Sufficient aisle space should be provided in front of the fume hood to avoid disruption of the work or interference with the operating technician by passing personnel.

Safety devices such as drench showers, eye wash stations, fire extinguishers, first aid kits and fire blankets should be located convenient to the fume hood operating personnel and plainly labeled as to their use and function.

Other safety factors to be considered:

Type of research being conducted;

Proximity to associated bench mounted or free standing instrumentation machines;

Type and number of associated fume hood enclosures;

Number of research and/or student users in laboratory space.

Refer to SEFA 2 Recommended Practices for Installation.

Refer to SEFA 7 Recommended Practices for Laboratory Fixtures.

5.3 Fume Hood Evaluation – As Installed

Precondition for Testing: The test of the fume hood should be performed after the installation is complete, the building ventilation and control system has been balanced and all connections made. The testing should be performed in conditions appropriate for occupation of the lab space.

It is recommended that the user make provisions to have the following test performed on all laboratory fume hoods. These tests should be performed by qualified personnel to verify proper operation of the fume hoods before they are put to use. Testing should be repeated at least annually, or whenever a significant change in the hood system occurs. Any unsafe conditions disclosed by these tests should be corrected before using the hood. It is recommended that hoods be tested in accordance with ASHRAE 110-1995 (or most current edition) before put into service. Some form of annual certification should be incorporated at the owners discretion.

The ASHRAE 110 test is a method of testing the performance of laboratory fume hoods. There are three test procedures incorporated into the 110 test; the first is the face velocity grid test, the second is the flow visualization or smoke test and the third is the tracer gas containment test. The ASHRAE 110 is the recognized method for evaluating the performance of fume hoods; ASHRAE has defined three modes, As Manufactured (AM), As Installed (AI), and As Used (AU). The ASHRAE test should be conducted by an authorized person cognizant of each of the three test procedures.

5.3.1 Room Conditions

Check room conditions in front of the fume hood using a thermal anemometer and a smoke source to verify that the velocity of cross drafts should be less than 50% of the face velocity, not to exceed 30 FPM. Any cross drafts that exceed these values shall be eliminated before proceeding with fume hood test. Crosscurrents of sufficient magnitude can have a detrimental effect on the ability of a fume hood to contain and exhaust air contaminants. It is therefore advised to keep crosscurrents in the vicinity of the face of a fume hood to a minimum.

5.3.2 Sash Operations

Check operation by moving sash(es) through its (their) full travel. Sash operation shall be smooth and easy. Vertical rising sashes shall hold at any height without creeping up or down, unless designed otherwise. Force to
open the sash shall be reasonable for the size and weight of the sash. Typically a five foot hood with a vertical rising sash shall require approximately five pounds of force to operate the sash. An additional one pound of force may be required for each additional linear foot of fume hood width.

5.3.3 Evaluation of Low Air Flow Monitor

On fume hoods with low flow warning devices, verify that monitor functions properly and indicates unsafe conditions.

5.3.4 Face Velocity

Determine specified average face velocity for fume hood being tested. Perform the following test to determine if fume hood velocities conform to specifications.

Face velocity shall be adequate to provide containment. Face velocity is not a measure of safety.

Refer to ASHRAE 110 – 1995 (or latest edition) for velocity measurement procedures.

Face Velocity Guide – The most widely accepted range of average face velocities is 60 FPM to 100 FPM. The measured deviation across the face may vary + 20 %. (For more information on this topic, refer to Section 12.0 Regulatory and Industry Consensus standards.)

5.3.5 Containment Testing – As Installed

SEFA recommends the ASHRAE 110-1995 (or most current edition) test.

5.4 Trouble Shooting

When fume hood test procedures detect improper function, the cause is frequently due to insufficient quantity of air flowing through the hood, or due to room cross drafts blowing into or across the face of the fume hood, or a combination of both. The following suggestions are offered to help pinpoint and correct the problems.

5.4.1 Insufficient Airflow

Insufficient airflow through the fume hood can be caused by one or more of the following conditions. Each condition should be checked, and eliminated if possible to determine which one or combination of conditions may exist:

• Double-check your readings.

• Check airflow velocity meter type. When was it calibrated last? Is the battery good? Was the instrument zeroed before taking readings?

• Check to make sure the instrument is recommended for low air velocities in the 50 to 150 feet per minute (.25 to .76 m/s.) range.

If possible, verify readings with another air velocity meter or by checking air volume using a pitot tube traverse of exhaust duct. Low airflow through the fume hood can be caused by a large negative room static pressure as a result of inadequate makeup air being brought into the room. With the fume hood and other exhaust unit in operation, check room static pressure by:

• Verification using inclined manometer.

• Checking inrush of air into the room through a door or an open window.

• Checking ventilation system balance and verify the quantity of makeup air.

• Verify that fume hood baffles are in an open position.

• Insure that baffle openings are not blocked with large or bulky apparatus. Improper sizing or operation of exhaust unit or both may be the cause.

• Confirm exhaust unit rotation is correct. Make and model is as specified.

• Supply voltage is correct.

• Motor horsepower and speed is appropriate.

• Exhaust unit inlet and outlet conditions are suitable.
• Check for special or bulky equipment that interferes with airflow through the fume hood.

5.4.2 Room Cross Drafts

Cross drafts in front of the fume hood face can cause the fume hood to lose containment and present a safety hazard to laboratory space occupants. Cross drafts in front of the fume hood should be kept to a minimum at all times and specifically when the fume hood is being used by an operator. Each of these issues should be investigated when cross drafts are suspected of causing poor fume hood performance.

Air moving through an open door located adjacent to the fume hood can cause cross drafts.

An open window or room air supply grill located to one side or across from the fume hood can cause disturbing cross drafts.

High velocity air from ceiling-mounted diffusers or room air supply can cause cross drafts or downdrafts.

Cross drafts can occur when thermal gradients in the lab space are caused by the introduction of supply air at a significant $T$, compared to the ambient temperature in the lab space. The proper operation of the building reheat controls, the position of the lab space thermostats and the supply register location can all affect the creation of these thermal gradients. Room conditions such as these should be avoided, if at all possible, by the location of the fume hood or changing the design of or modifying the location of supply air diffusers. The velocity of the cross drafts should not exceed 50% of the face velocity or 30 FPM.

5.4.3 Exhaust Unit and Duct Considerations

Where laboratory building design permits, the exhaust unit should be located on the roof of the building to provide a negative pressure in that portion of the duct system located within the building.

The exhaust unit should be sized to exhaust the volume of air necessary to attain the selected fume hood face velocity at the total system static pressure loss. Care should be taken to ensure the exhaust unit has sufficient stack velocity and orientation to reduce the possibility of re-entrainment of contaminated exhaust air into the lab building, or an adjacent building’s supply air intakes.

Exhaust units should be sized to achieve the lowest practical angular speed of the impeller, thereby avoiding high impeller tip speed and minimizing noise associated with this revolving member.

Ductwork shall be designed and constructed in accordance with approved standards (ASHRAE, NFPA, SMACNA) and regulations, for minimal friction losses within the duct, smooth interior surfaces are recommended.

Elbows, bends and offsets within a duct system should be kept to a minimum and should be long sweep in design configuration in order to minimize static pressure losses. When practical, a straight run of duct from the fume hood duct collar for as long a length as possible, is preferred.

Fume hood and other exhaust devices shall not interconnect with re-circulating systems.

5.4.4 Make-up Air

Make-up air is a ventilation term indicating the supply of outdoor air to a building replacing air removed by exhaust ventilation systems. In general, laboratories require four to twelve total volume changes per hour. Refer to OSHA 1910.1450, Page 492 and NFPA 45, 2000, Page 45-27, A.6.3.3. Special applications may require more air changes per hour.

A sufficient quantity of makeup air must be available to allow fume hoods to develop required face velocities.

Consideration must be given to the makeup required for air changes in each specific laboratory involved. This data must be coordinated with fume hoods and ventilation equipment.

In order to provide a balanced and functioning system, all factors such as fume hood exhaust volume, air change data, makeup air systems and
auxiliary air performance, if applicable, must be considered.

Due to the possibility of toxic and/or hazardous material being handled within laboratories, air exhausted from these laboratories should not be re-circulated.

Laboratories using chemicals should operate at a slight negative pressure as compared to the remainder of the building.

5.4.5 Laboratory Fume Hood Inspection and Maintenance

Inspection procedures should include instrument verification of fume hood face velocity, which should be equal to the velocity recorded at the time of the ASHRAE 110-95 (or latest edition) performance test and fume hood commissioning.

Inspection procedures should consist of a physical examination of liner condition and cleanliness, baffle and sash operation and condition, counter balance cables, light operation and condition, and service fixture function.

Inspection results should be recorded and reported to the proper authority for any required action. Where extremely hazardous or corrosive conditions exist or when filters are present in the system, the inspection frequency should be increased appropriately. Velocity and pressure sensing detectors should be tested at each inspection. Low-flow or no-flow alarms of the visible or audible type should be tested for correct operation at least at each inspection. Fan belts should be inspected regularly.

5.5 Maintenance

Fume hood maintenance procedures consists primarily of clean up, adjustments, lubrication and replacement of worn, damaged or nonfunctioning parts. Use good housekeeping in laboratory fume hoods at all times. Periodically clean sash(es), exterior and interior surfaces, including light panel. Replace lamps periodically to maintain adequate illumination.

Clean up should be accomplished by, or under the supervision of a knowledgeable laboratory safety officer and should include removal of the baffle for clean up of all interior surfaces.

Lubrication of sash guides, cables, pulley wheels, sprockets, chains and other working parts should be accomplished as required or in accordance with manufacturer's recommendations.

Flush all spills immediately using neutralizing compounds as required and clean thoroughly.

6.0 Laboratory Fume Hoods - As Used

6.1 Safe Work Practices

The employer is responsible for ensuring that the hood meets satisfactory safety standards. A hood operator is responsible for ensuring that the hood is used in a safe manner and according to your organization's safety guidelines. A hood operator is also responsible for helping their organization maintain proper operation of the hood systems.

The following guidelines are provided to help reduce your potential for exposure when working with hazardous materials.

- Plan for conducting experiments.
- Wear appropriate personal protection.
- Verify proper system operation.
- Utilize proper work practices.

6.2 Plan for Conducting Experiments

Prior to conducting potentially hazardous procedures in a laboratory fume hood, evaluate the hazards and consult with a Safety Officer to develop appropriate safety protocols and evaluate whether the hoods and systems have the capability to provide adequate protection. In addition, follow the guidelines provided in your Chemical Hygiene Plan. If the guidelines are inadequate or inappropriate, help develop or amend procedures with your Chemical Hygiene Officer.

Prior to starting an experiment in a hood, answer the following questions:
What are the characteristics of the hazards associated with the procedure?

Is this the right type of hood?
Will the hood accommodate the equipment and experimental apparatus?

Is the hood capable of capturing and exhausting the contaminants?

What are the hood capabilities and limitations?
What special precautions are required?

Verify that the ventilation system is working properly.

For example, if you are going to conduct a procedure involving use of heated perchloric acid, you must use a perchloric acid hood and the exhaust system must be equipped with a water wash down system. Failure to use a perchloric acid hood with a water wash down system could result in a future explosion or fire. Another example is to be cautious with a heat generating processes. Generated velocity due to the heat in a hood could result in counterproductive airflow. Is the fume hood liner resistant to the heat loads?

6.4 Fume Hood Evaluation - As Used

The ASHRAE 110 test is a method of testing the performance of laboratory fume hoods. There are three test procedures incorporated into the 110 test; the first is the face velocity grid test, the second is the flow visualization or smoke test and the third is the tracer gas containment test. The ASHRAE 110 is the recognized method for evaluating the performance of fume hoods; ASHRAE has defined three modes, As Manufactured (AM), As Installed (AI), and As Used (AU). The ASHRAE test should be conducted by an authorized person cognizant of each of the three test procedures.

Safety considerations require that a schedule of inspection and documentation be set up for every laboratory fume hood at least annually.

An inspection record should be maintained. This record may be in the form of a label attached to the fume hood, and/or a log maintained by the Laboratory Director or Health Safety Director. Include sash operation, low airflow monitor, and containment test evaluations.

Before generating hazardous materials within the hood, you should ensure that the hood system is in good working order.

Check the hood integrity and verify adequate exhaust flow or face velocity. At a minimum, check the hood inspection notice to ensure that the hood has been recently tested and operation was satisfactory at the time of the tests.

As hoods are part of a mechanical system, it is possible that operational problems could develop between routine performance tests and preventative maintenance activities. Report alarms or suspected operational problems immediately.

If any problems are suspected with hood operation, immediately contact your Chemical Hygiene Officer or follow your facility’s procedure for reporting problems.

Verifying proper system operation without a hood monitor is very difficult. All hoods shall have some

6.3 Wear Appropriate Personal Protection

Prior to conducting experiments wear appropriate personal protective apparel as required by the Chemical Hygiene Program and safety protocols. It is generally accepted that at a minimum, the appropriate apparel for working at a laboratory fume hood includes approved eye protection, lab coat, gloves, long pants and shoes (preferably safety shoes, open shoes such as sandals are not recommended).

Ensure that clothing and glove materials are appropriate for work with the hazards. For example, vinyl gloves provide excellent resistance to formaldehyde, but poor resistance to chloroform.

If unsure of the appropriate type of personal protective equipment required, consult with your Chemical Hygiene Officer.
type of monitor to verify proper exhaust flow and/or average face velocity. If your hood does not have a monitor, request one.

6.5 Utilize Proper Work Practices

Ultimately the ability of the hood to provide adequate protection depends on the user. By utilizing proper work practices, the potential for exposure can be reduced. Limitations inherent in many hoods and systems make proper work practices required to optimize containment.

6.5.1 Proper Location of Equipment and Apparatus

The location of equipment and apparatus effects the airflow patterns within the hood. Vortices form downstream of a person standing at the opening. When obstructions are placed directly in front of the operator or improperly located within the hood, the problems with reverse flow and turbulence can be exacerbated.

The following guidelines are provided for properly locating equipment and apparatus within the hood:

Always locate equipment as deep into the hood as practical and at least six to eight inches beyond the plane of the sash. For hoods that have a recessed work area, equipment and apparatus should not be placed on the raised ledge in front of the work area.

Equipment should never extend beyond the plane of the sash or restrict the sash from closing.

Elevate equipment two to three inches above the work surface to provide flow beneath and around the equipment.

Ensure that elevated equipment is stable. Plexiglas or stainless steel slotted shelves can be used to elevate equipment and apparatus above the bottom slot in the baffle. Slotted or perforated shelves minimize disruption to airflow patterns.

Excessive equipment and apparatus in the hood should be avoided. As a rule of thumb, no more than 50% of the work surface should be covered by equipment, apparatus or other bulky obstructions.

Caution is advised when placing equipment requiring electrical power in the hood. The equipment must be properly grounded to reduce the potential for sparks. Power cords should be plugged in a properly grounded and approved outlet.

High heat loads create thermal drafts which

![Diagram showing effects of locating equipment, materials and apparatus in the fume hood](image)

Fig. 9 Diagram Showing Effects of Locating Equipment, Materials and apparatus in the Fume Hood
increase face velocity through the bottom of the fume hood opening and thus lower face velocities at the top of the fume hood opening. Excessive heat loads can cause the fume hood to lose containment. If high heat loads are expected during the normal operation of the fume hood ASHRAE testing should be conducted under the same conditions to test fume hood performance.

If a distillation rack (also known as “lattice rack” or “monkey bars”) is installed in the fume hood, the rack should be positioned in such a location that it is accessible from the operating sash opening.

6.5.2 Desired Operator Position and Movements

The hood user should always be aware of locations within the hood where concentrations of contaminants can accumulate. The user should never allow his head to break the plane of the sash because this will cause contaminated air to pass through the breathing zone.

When materials are being generated in the hood, ensure that you slowly approach and withdraw from the hood. The wake zone created by movement near the hood opening can withdraw materials from within the hood.

Rapid arm and body movements near the hood opening should be avoided.

6.5.3 Proper Configuration of Vertical and Horizontal Sliding Sashes

The vertically sliding sash should always be lowered as much as possible to protect the user and to minimize visual obstruction from sash handle. Raise the sash to full open position for set-up purposes only.

Reducing the sash to below the user’s breathing zone provides a protective barrier between the researcher and the experiment.

As air enters the opening of a hood with horizontal sash panels, turbulent vortices develop along the vertical edges of the sash panels. The vortex, readily visualized using smoke, can extend deep into the hood and draw contaminants toward the edges of the sash panels.

High concentrations can develop near the edge of the sash panels regardless of the generation location within the hood. Although escape is not usually observed, rapid movements near the sash.

Fig. 10 Diagram of Proper Locations for Generating Hazardous Material within the Hood
edge or turbulence resulting from cross drafts could cause escape.

A horizontal sash panel provides an effective barrier to splashes or explosions, but remember that high concentrations can develop inside the sash panels. As a general rule, you should avoid rapid movements near the vertical edges of the sash panels.

Avoid rapid withdrawal from the hood.

**6.5 Utilize Proper Work Practices**

Ultimately the ability of the hood to provide adequate protection depends on the user. By utilizing proper work practices, the potential for exposure can be reduced. Limitations inherent in many hoods and systems make proper work practices required to optimize containment.

**6.5.1 Proper Location of Equipment and Apparatus**

The location of equipment and apparatus affects the airflow patterns within the hood. Vortices form downstream of a person standing at the opening. When obstructions are placed directly in front of the operator or improperly located within the hood, the problems with reverse flow and turbulence can be exacerbated.

The following guidelines are provided for properly locating equipment and apparatus within the hood:

Always locate equipment as deep into the hood as practical and at least six to eight inches beyond the plane of the sash. For hoods that have a recessed work area, equipment and apparatus should not be placed on the raised ledge in front of the work area.

Equipment should never extend beyond the plane of the sash or restrict the sash from closing.

Elevate equipment two to three inches above the work surface to provide flow beneath and around the equipment.

Ensure that elevated equipment is stable. Plexiglas or stainless steel slotted shelves can be used to elevate equipment and apparatus above the bottom slot in the baffle. Slotted or perforated shelves minimize disruption to airflow patterns.

Excessive equipment and apparatus in the hood should be avoided. As a rule of thumb, no more than 50% of the work surface should be covered by equipment, apparatus or other bulky obstructions.

Caution is advised when placing equipment requiring electrical power in the hood. The equipment must be properly grounded to reduce...
the potential for sparks. Power cords should be plugged in a properly grounded and approved outlet.

High heat loads create thermal drafts which increase face velocity through the bottom of the fume hood opening and thus lower face velocities at the top of the fume hood opening. Excessive heat loads can cause the fume hood to lose containment. If high heat loads are expected during the normal operation of the fume hood AU ASHRAE testing should be conducted under the same conditions to test fume hood performance.

If a distillation rack (also known as “lattice rack” or “monkey bars”) is installed in the fume hood, the rack should be positioned in such a location that it is accessible from the operating sash opening.

6.5.2 Desired Operator Position and Movements

The hood user should always be aware of locations within the hood where concentrations of contaminants can accumulate. The user should never allow his head to break the plane of the sash because this will cause contaminated air to pass through the breathing zone.

When materials are being generated in the hood, ensure that you slowly approach and withdraw from the hood. The wake zone created by movement near the hood opening can withdraw materials from within the hood.

Rapid arm and body movements near the hood opening should be avoided.

6.5.3 Proper Configuration of Vertical and Horizontal Sliding Sashes

The vertically sliding sash should always be lowered as much as possible to protect the user and to minimize visual obstruction from sash handle. Raise the sash to full open position for set-up purposes only.

Reducing the sash to below the user’s breathing zone provides a protective barrier between the researcher and the experiment.

As air enters the opening of a hood with horizontal sash panels, turbulent vortices develop along the vertical edges of the sash panels. The vortex, readily visualized using smoke, can extend deep into the hood and draw contaminants toward the edges of the sash panels.
High concentrations can develop near the edge of the sash panels regardless of the generation location within the hood. Although escape is not usually observed, rapid movements near the sash edge or turbulence resulting from cross drafts could cause escape. A horizontal sash panel provides an effective barrier to splashes or explosions, but remember that high concentrations can develop inside the sash panels. As a general rule, you should avoid rapid movements near the vertical edges of the sash panels.

Avoid rapid withdrawal from the hood.

Close horizontal panels on combination sashes before opening the sash vertically, to ensure the open sash area does not exceed the maximum, as per the exhaust flow design.

Always close the sash when not working in the hood.

**6.5.4 Reduce Pedestrian Traffic Near The Hood**

A person walking past the hood can generate significant cross drafts. When generating hazardous materials in the hoods, attempt to divert or limit traffic past the hood. Inform other laboratory personnel about the work being conducted in the hood.

**6.5.5 Ensure Hoods are Cleaned and Decontaminated**

Following procedures involving highly toxic, potent or radioactive materials, the hood interior should be cleaned and decontaminated. Contaminated hoods should be clearly labeled. Maintenance personnel should also be informed of the potential for duct contamination. In several cases, maintenance personnel have been injured while working on hood systems that have been used for work with perchloric acid and appropriate decontamination methods had not been followed.

**6.5.6 Do Not Store Materials In The Hood**

Laboratory fume hoods should not substitute for an approved chemical storage cabinet. Hood performance is impaired by excessive storage of materials in the hood and the available work surface is reduced.

**6.5.7 Summary of Proper Work Practices**

The following list summarizes guidelines for working in a chemical hood:

Always work at least six inches beyond the plane of the sash. The farther the work is into the hood the better.

Avoid rapid withdrawal from the hood.

Close horizontal panels on combination sashes before opening the sash vertically.

Always close the sash when not working in the hood.

Baffles should only be adjusted per manufacturer’s recommendation. If baffle settings are modified, it is recommended that the fume hood is tested to the ASHRAE 110 standard under all baffle configurations.

Elevate contaminants and equipment above the surface of the hood to enable flow beneath and around the obstructions.

If equipment and material storage is necessary, locate along the sidewalls or well away from the point of contaminant generation. Do not store any equipment that restricts the closing of the sash or blocks the bottom slot of the baffle directly in front of the user.

Keep movements in the hood and in front of the hood to a minimum.

Keep motion in the lab to a minimum while working in the hood. Traffic past the hood can generate considerable cross drafts.

Ensure head and upper body remains outside the plane of the hood opening at all times.

Always attempt to slowly approach and withdraw from hood. Open and close the sash slowly.
6.6 Responsibilities for Ensuring Proper Hood Performance

Ensuring performance of laboratory fume hood systems is the combined responsibility of:

<table>
<thead>
<tr>
<th>Group</th>
<th>Responsibility</th>
</tr>
</thead>
<tbody>
<tr>
<td>Management (6.6.1)</td>
<td>Ensure health and safety of laboratory personnel</td>
</tr>
<tr>
<td>Principal Research Investigators (6.6.2)</td>
<td>Provide information about hazards and scientific procedure</td>
</tr>
<tr>
<td>Health and Safety (6.6.3)</td>
<td>Develop Safety Operating Procedures (SOP)</td>
</tr>
<tr>
<td>Lab Design Team And Engineering (6.6.4)</td>
<td>Identify needs and design/specify appropriate building system, fume hoods and laboratory components</td>
</tr>
<tr>
<td>Construction Team (including laboratory fume hood installer (6.6.5)</td>
<td>Construct/install in accordance with contract documents</td>
</tr>
<tr>
<td>Controls Manufacturer (6.6.6)</td>
<td>Provide Product(s) in accordance with contract documents</td>
</tr>
<tr>
<td>Building System Commissioning (6.6.7)</td>
<td>Verify function of lab controls and the ability of the system to meet all required set points</td>
</tr>
<tr>
<td>Operations and Maintenance (6.6.8)</td>
<td>Develop and implement Operations and Maintenance Program</td>
</tr>
<tr>
<td>Laboratory Personnel and Laboratory Fume Hood Users (6.6.9)</td>
<td>Comply with Standard Operating Procedures (SOP)</td>
</tr>
<tr>
<td>Laboratory Fume Hood Manufacturer (6.6.10)</td>
<td>Provide product(s) in accordance with contract documents. Provide product(s) that perform in accordance with safety standards</td>
</tr>
</tbody>
</table>

Although your organization’s management is ultimately responsible for the health and safety of laboratory personnel, a team approach is required to ensure proper performance of laboratory fume hood systems.

The following list provides a summary of responsibilities for each group involved with ensuring proper operation of laboratory fume hood systems.

6.6.1 Management

Provide commitment to health and safety.

Provide leadership.

Direct and coordinate activities.

Allocate sufficient resources.

6.6.2 Principal Research Investigators

Identify personnel risks and characterize scientific procedures.

Evaluate hazard potential.

Work with Health and Safety to develop safety protocols, training programs, and select appropriate hoods.

Submit all requests for new hoods to Health and Safety.

Inform Health and Safety of significant changes in research activities.

Support (embrace) Health and Safety’s Standard Operating Procedures.

6.6.3 Health and Safety

Develop and manage the Chemical Hygiene Plan (Standard Operating Procedures).

Administer Laboratory Fume Hood Safety Program.

Determine exposure control requirements.

Provide hood operators with MSDS information on materials being used in the fume hood.
Ensure proper selection and use of hoods. Determine protocol for proper operation.

Ensure users are informed of hood capabilities and limitations (Training).

Develop and review safety standards periodically.

Conduct and/or review periodic hood performance tests.

Review all requests for new hoods.

Confirm that hood performs as required.

6.6.4 Laboratory Design Team and Engineering Identify needs.

Design appropriate building system (architectural, mechanical, electrical, plumbing, structural etc.).

Design and specify appropriate fume hood system.

Assist with pre-qualification of construction team.

Review all proposed changes.

Prepare “as built” documents.

Ensure design intent is achieved and commissioned.

6.6.5 Construction Team

Construct and install in accordance with contract documents, and regional, local and national codes.

Provide coordinated effort to meet design and performance requirements.

Coordinate field changes with other appropriate team members.

6.6.6 Controls Manufacturer

Supports design and specification of appropriate fume hood control system.

Provide product in accordance with specifications and contracts.

Provide start-up of fume hood control system.

Provide training in proper operations and maintenance for product.

6.6.7 Building System Commissioning

Verify fume hood flow rate.

Verify function of controls.

Verify ability to meet design set points for temperature, airflow, and room pressurization.

6.6.8 Operation and Maintenance

Ensure regular maintenance on all system components.

Ensure proper operation within specified tolerances.

Ensure no unauthorized changes to hood systems.

Ensure maintenance personnel are familiar with hazards and safe work procedures.

Ensure maintenance personnel are fully trained.

6.6.9 Laboratory Personnel and Hood Users

Understand the hazards.

Understand the capabilities and limitations of hoods.

Verify proper operation prior to use.

Use proper work practices in compliance with SOP.

Report suspected operational problems.

6.6.10 Hood Manufacturer

Hood is built to specifications.

Hood performs as expected “as manufactured.”
Technical information associated with hood design.

Hood shall be manufactured in conformance with SEFA-1.

Provide product training and verification as requested.

Provide basic safety precautions posted clearly on the fume hood.

Provide troubleshooting assistance when hood fails to meet expectation “as installed.”

7.0 Laboratory Ventilation Systems

Laboratory ventilation systems include both exhaust and supply duct systems. The purpose of a laboratory exhaust system is to exhaust a specific volume of air from laboratory fume hoods or other exhaust devices and safely transport the contaminated air from the building in a manner that reduces the potential for re-entrainment of exhaust fumes into the fresh air intake in the building. According to a number of industry standards, the supply air system must make up the air exhausted from the laboratory with 100% fresh outside air, conditioning it to provide a safe and comfortable work environment for the lab space occupants. The amount of supply air delivered to a laboratory is controlled to satisfy the demand for minimum ventilation (ACH) rate, hood flow demand or cooling / heating load demand, whichever is greater. In order to maintain the negative pressure requirement, the total exhaust volume for a lab must always exceed the supply air volume by a specific volumetric offset or the flows must be controlled by a pressure differential control system. The volumetric offset method is the most common. If the total of all hood exhaust is less than the maximum possible supply flow, an additional exhaust device, normally referred to as the general exhaust valve, is required.

Many factors affect the performance of hoods and laboratories, none of which receives more discussion than the airflow control strategy. The flow control strategy significantly impacts laboratory fume hood containment, room pressurization and energy usage.

7.1 Airflow Control Strategy

There are three main airflow control strategies for laboratories with fume hoods.

The first and most widely used, Constant Volume (CV), has been in use since the early 20th century. Second is Two-State Control (2SC), introduced in the 1960’s. And finally, Variable Air Volume (VAV) has been gaining popularity and effectiveness since the 1980’s. Specific applications are well suited to each. The energy efficient fume hood designs can be used on any of these systems and can further reduce the total volumetric flow requirements of the HVAC system.

7.1.1 Constant Volume (CV)

Constant volume systems are designed to exhaust a constant volume of air from the laboratory fume hood regardless of hood use, sash position or operating mode. Caution must be exercised by the designer and commissioning agent to ensure that sash stops and flows are properly selected, and you consult with the hood manufacturer for proper airflow requirements.

7.1.2 Two-State Control

Two-state fume hood control is simply a low/high volume control system. This control approach gains energy efficiency over CV systems to the extent that the hoods remain in the low flow level.

The low and high volumes are changed by various methods such as a sash position switch, light switch, and user presence sensors, the most common of which are sash switches and wall (manual) switches. Sash switches are used to change the flow based on the open area of the fume hood sash.

The energy savings of the two-state approach is improved over constant volume, but may require an audible alarm that reminds a hood user to close the sash. The use of controls also adds more maintenance costs to the system, compared to a CV system.
7.1.3 Variable Air Volume (VAV) Systems

A variable air volume fume hood control system is designed to vary the hoods' exhaust rate to maintain a constant average face velocity throughout the sash travel. The complexity of this system requires fast, stable control systems, which are more expensive, on an installed cost basis, than constant volume control systems. Energy savings can be further improved to potentially offset these higher costs.

Room pressurization is commonly maintained by adjusting the make up air to a fixed offset relative to the total exhaust flow. A small percentage of facilities choose to maintain pressurization by controlling the pressure differential.

If the minimum total hood flow for a laboratory is lower than the exhaust flow required to maintain the negative pressure in the lab, a general exhaust device may be required to provide minimum ventilation and proper temperature control. In this case, the total exhaust (hoods plus general exhaust) airflow rate is increased to overcome the added supply requirements.

Below is a diagram of a simple VAV system. (See: Figure 14).

7.1.4 Summary of Air Control Strategies

The cost of operating a laboratory fume hood is very significant and will continue to be a major concern until alternative forms of renewable energy are readily available. As of early 2002, the range of first pass estimates range from $4 to $7 per CFM per year to operate the laboratory ventilation systems. Reducing flows when appropriate, through the use of an energy efficient fume hood design and/or through a usage-based flow setback, can result in significant cost savings.

One of the primary goals of the designer is to provide a safe environment for researchers. Meeting this objective requires containment at hoods and at the room level. Room pressurization is an important consideration for laboratories.

7.2 Room Pressurization

The standards and guidelines stress the importance of room pressurization for laboratory spaces. Laboratories that use laboratory fume hoods should be maintained at a relative negative pressure to corridors and other adjacent spaces in the building (with the exception of clean room laboratories that may operate under positive pressure).
7.3 Diversity

Diversity is used by engineers in designing systems based on its practical or maximum expected use, not its total possible use. When diversity is applied to sizing of systems, the design capacity is less than the sum of peak demands.

Both existing and new laboratories can benefit from applying diversity to the HVAC design. Diversity allows existing facilities to add fume hood capacity using the current HVAC systems. Diversity design in new construction allows the facility to reduce capital equipment expenditures by downsizing the mechanical systems during the design phase.

Diversity can be applied only after providing the required number of air changes in the laboratory and the minimum flow to control room temperature. For these reasons, some laboratories cannot reduce the total hood exhaust flow capacity.

For either type of facility, designers must develop a solution that best fits the customers’ needs. However, some designers are hesitant to use diversity since the savings are only realized when the sashes are lowered. Often, this has lead to systems with methods of “forced” diversity that have proven problematic.

Mechanical sash stops prevent a user from opening a sash beyond a predetermined maximum setting. Unfortunately, users often override these mechanical stops for everyday activity and for setting up experiments. This can create a dangerously low face velocity profile if the controller is not sized for full sash opening and if the fume hood is not designed to operate at lower face velocities. Insure that low flow alarms are working properly.


Some Factors Affecting Diversity:

Control Method
- Constant Volume CV
- Variable Air Volume VAV
- Two State Controls

Usage Pattern
- Number of users per fume hood
- Fume hood usage type
- User compliance

Sash
- Sash type
- Sash management

Airflow Requirements
- Face velocity
- Cooling airflow rate
- Minimum ventilation rate

Number of Floors and Size of Building

Fume Hood Density
- Number of fume hoods per lab
- Number of fume hoods per manifold

8.0 Other Ventilated Laboratory Safety Devices

All ventilated devices used in a laboratory are safety devices and should be carefully examined for application and safe working practice. Some experts believe that all ventilated enclosures should be called a laboratory fume hood and tested to fume hood standards. This is not possible because many enclosures are suitably made of flammable materials, are sized for their application and operate safely for the intended purpose, but not as a fume hood.

Products described in this section are not fume hoods by the definition in Section 3. Testing of these products is not covered in the ASHRAE 110-1995 (or most current edition) Standard. As
such, great care must be taken to insure that the product being evaluated is functioning safely for the intended purpose. It is not possible for SEFA to presuppose all applications and as such this section is intended to be used as a guideline only, not a definitive source. Contact your Chemical Hygiene Officer to evaluate your specific application.

8.1 Special Purpose Hoods

Special purpose hoods are hoods that are modifications of fume hoods. As such, they fail to meet the exacting definition of a fume hood and shall be classified as a special purpose hood. Common modifications to fume hoods include: baffle designs, sash configurations and locations, size, and materials. Special purpose hoods are designed specifically for that purpose, where a fume hood tends to serve a more general application. Special purpose hoods shall be designed, tested, and operated with their respective intended purpose in mind.

8.1.1 Demonstration Hood

Examples – Multi Sided, Pass Through Hood, Dual Entry Hood, Trifacial Hood

Description

A demonstration hood is a bench hood that provides visibility of the hood interior from multiple sides. Often a demonstration hood provides access from two or more sides. Demonstration hoods may or may not have a baffle system.

Purpose or Application

A demonstration hood is typically used by educators who interact with students via demonstration of experiments. A demonstration hood may or may not function as a fume hood because they typically deviate from traditional baffle systems, sash arrangements and often do not utilize front airfoils.

Reference Organization

None

Testing Recommendations

Some hoods may be tested using the ASHRAE 110-1995 (or most current edition) Standard. Others will require test modifications due to size, sash location, and when to test for multiple sash positions. Consideration must be made to the toxicity of the experiment and acceptable exposure levels. The manufacturer should make recommendations for the specific testing of this product including a velocity profile, smoke visualization, and a filter integrity test if a filter is part of the system.

Additional Comments

Contact your Chemical Hygiene Officer for safe exposure levels and for testing recommendations before working in a demonstration hood.

8.1.2 California Hood

Description

A California hood is an enclosure that has access to at least two sides, and it usually provides visibility from all four sides similar to a demonstration hood. A California hood differs from a demonstration hood in that it is taller than a bench hood (floor-mounted height), is always set atop a pedestal, and comes equipped with a distillation rack.

Purpose or Application

A California hood is used when large distillation apparatus is required and fumes from the distillation should not be present in the open laboratory.

Reference Organization

None

Testing Recommendations

ASHRAE testing must be modified because the hood opening is much larger than a bench laboratory fume hood and has multiple sash configurations. Containment levels for California hoods are normally unfavorable to fume hood
specifications since the hood rarely has a baffle system, and has unique sash configurations. The manufacturer should make recommendations for the specific testing of this product including a velocity profile, smoke visualization, and a filter integrity test if a filter is part of the system.

**Additional Comments**

Contact your Chemical Hygiene Officer for safe exposure levels, special considerations during set-up and tear-down, and for testing recommendations before working in a California hood.

### 8.1.3 Ventilated Hoods and Enclosures

A ventilated enclosure is a general term used to describe any special purpose hood that is otherwise not specifically described as a California hood or demonstration hood.

#### 8.1.3.1 Oversized Hood

**Description**

Laboratory fume hoods are sometimes built in large, non-standard sizes to accommodate a specific application. Generally, laboratory fume hoods as long as twenty feet reflect the basic tenet of a laboratory fume hood, but larger structures may not. These larger structures shall be referred to as oversized hoods and not a laboratory fume hood.

**Purpose or Application**

Oversized hoods are often designed to accommodate a specific piece of equipment that must be housed in the hood during the experiment. Sometimes the scale of the work done in the hood determines the desired size of the hood.

**Reference Organization**

None

---

**Testing Recommendations**

Extensive knowledge of the testing apparatus or experimentation, or work being done in the hood is required for determining the safe testing methods of an oversized hood. Contact your Chemical Hygiene Officer before working in an oversized hood. The manufacturer should make recommendations for the specific testing of this product including a velocity profile, smoke visualization, and a filter integrity test if a filter is part of the system. Testing an oversized hood will require extensive interpretations of the ASHRAE 110-1995 (or most current edition) test procedure. Oversized hoods may require more and different diffuser locations, and sash arrangements must be considered before testing.

**Additional Comments**

Contact your Industrial Hygienist for safe exposure levels, proper use of sash positions, special considerations during set-up and tear-down, operating procedures and for testing recommendations before working in an oversized hood.

#### 8.1.3.2 Table Top Hood

**Examples – Portable Hood, Down Draft Hood**

(A Down Draft Hood is a Table Top Hood that is vented down through the table top into an exhaust fan system).

**Description**

A portable hood is a ventilated enclosure that is small (usually less than 15 cubic feet of working space), is often made of alternate materials (such as epoxy, polycarbonate, acrylic or sheet metal) for mounting on a tabletop.

**Purpose or Application**

Used primarily in educational laboratories to control nuisance contaminants or small, microscale experiments.

**Reference Organization**

None
Testing Recommendations

A table top hood may be tested to the ASHRAE 110-1995 (or most current edition) test if the hood is large enough to contain the apparatus and a sash is apparent. If not, evaluate containment by modifying the test methods or by smoke visualization. The manufacturer should make recommendations for the specific testing of this product including a velocity profile, smoke visualization, and a filter integrity test if a filter is part of the system.

Additional Comments

Do not use this product for anything but nuisance vapor protection, unless otherwise certified by your Chemical Hygiene Officer.

8.1.3.3 Conventional Hood

Examples – Flat Front Hood, Thin Wall Hood

Description

A conventional hood is a ventilated bench mounted enclosure that exhibits a square entry profile, and usually lacks a bypass, and airfoil.

Purpose or Application

Used primarily in educational laboratories to control nuisance contaminants or small, microscale experiments.

Reference Organization

None

Testing Recommendations

A conventional hood may be tested to the ASHRAE 110-1995 (or most current edition) test if the hood is large enough to contain the apparatus and a sash is apparent. If not, evaluate containment by modifying the test methods or by smoke visualization. The manufacturer should make recommendations for the specific testing of this product including a velocity profile, smoke visualization, and a filter integrity test if a filter is part of the system.

8.1.3.4 Balance Enclosure Description

A balance enclosure is a ventilated enclosure designed to specifically house a laboratory balance. These enclosures require good visibility and are typically made of transparent materials such as acrylic, polycarbonate, or glass. Balance enclosures should include baffles, tapers, slots or airfoils to reduce turbulent airflow. Access to the balance enclosure is usually from the sides; however, other access depends upon the accessibility needs.

Purpose or Application

Exposure to fumes from a balance is usually low; however, the proximity of the user’s breathing zone to the use of a balance could result in unacceptable exposure levels. It is best to house the balance in a ventilated enclosure. Balance enclosures are designed to protect users and the laboratory environment by directing the airflow away from the breathing zone of the user and exhausting the contaminated air out of the room.

Reference Organization

None

Testing Recommendations

The manufacturer should provide testing data and make recommendations for the specific testing of this product including a velocity profile, smoke visualization, and a filter integrity test if a filter is part of the system.

Additional Comments

This product should be used with caution. Contact your Chemical Hygiene Officer for the proper application, set-up and use of a conventional hood.

8.1.3.5 Microscope Enclosure Description

A microscope enclosure is a ventilated enclosure designed to specifically house a laboratory
microscope and to provide adequate protection to the user of the microscope. These enclosures require good visibility and are typically made of transparent materials such as acrylic, polycarbonate, or glass. Microscope enclosures should include baffles, tapers, slots or airfoils to reduce turbulent airflow. Access to the microscope enclosure is usually from the front and/or sides and should provide sufficient room for the user to perform necessary operations comfortably. Individual designs vary with the size and style of the microscope and application.

**Purpose or Application**

Exposure to fumes from a microscope is usually low; however, the proximity of the user’s breathing zone to the use of a microscope could result in unacceptable exposure levels. It is best to house the microscope in a ventilated enclosure. Microscope enclosures are designed to protect users and the laboratory environment by directing the airflow away from the breathing zone of the user and exhausting the contaminated air out of the room.

**Reference Organization**

None

**Testing Recommendations**

The manufacturer should provide testing data and make recommendations for the specific testing of this product including a velocity profile, smoke visualization, and a filter integrity test if a filter is part of the system.

**Additional Comments**

Provisions may be necessary to allow electrical connection of the microscope. Proper care must be exercised to avoid a spark within the chamber, which may contain flammable effluents.

**8.1.3.6 Robotic Enclosure Description**

A robotic enclosure is a ventilated enclosure designed to specifically house a laboratory robot or automated equipment and to provide adequate protection to the laboratory personnel near the robot. Robotic enclosures are typically made of transparent materials such as acrylic, polycarbonate, or glass. Robotic enclosures may or may not have a baffle system. Individual designs vary with the size and style of the robotic equipment and application.

**Purpose or Application**

Exposure to fumes from a robot is usually low; however, the proximity of the user’s breathing zone to the use of a robot could result in unacceptable exposure levels. It is best to house the robot in a ventilated enclosure. Robotic enclosures are designed to protect users and the laboratory environment by directing the airflow away from the breathing zone of the user and exhausting the contaminated air out of the room.

**Reference Organization**

None

**Testing Recommendations**

The manufacturer should provide testing data and make recommendations for the specific testing of this product including a velocity profile, smoke visualization, and a filter integrity test if a filter is part of the system.

**Additional Comments**

Proper care must be exercised to avoid a spark within the chamber, which may contain flammable effluents.

**8.1.3.7 Histopathological Enclosures**

Examples – Autopsy, Necropsy Enclosures, Tissue Trimming Enclosures, Tissue Staining, Fixing, Embedding Enclosures

**Description**

A histopathological enclosure is a hood specifically designed to enclose histopathological operations such as autopsy, necropsy, tissue trimming, tissue staining, fixing, slide and sample preparation. A histopathological enclosure shall provide adequate protection to the user and to the laboratory personnel. Histopathological
enclosures are typically made of transparent materials such as acrylic, polycarbonate, or glass. Histopathological enclosures usually have a baffle system. Individual designs vary with the equipment and application.

**Purpose or Application**

Histopathological enclosures are used to protect the users and their environment from potentially hazardous and noxious aerosols that may be present or formed during the histopathological operation. The histopathological enclosure shall exhaust the contaminated air out of the room and away from laboratory personnel.

**Reference Organization**

None

**Testing Recommendations**

The manufacturer should provide testing data and make recommendations for the specific testing of this product including a velocity profile, smoke visualization, and a filter integrity test if a filter is part of the system.

**Additional Comments**

Proper care must be exercised to avoid a spark within the chamber, which may contain flammable effluents.

---

8.2 **Local Exhaust Ventilation**

8.2.1 **Canopy Hood Description**

A canopy hood is a ventilated enclosure suspended directly above the work area.

**Purpose of Application**

Canopy hoods are receiving hoods. As such a canopy hood shall be used when there is a force, such as heat, to deliver the contaminant to the receiving hood.

**Reference Organization**


---

8.2.2 **Slot Hood Description**

A slot hood is a local exhaust ventilation device that is positioned adjacent and at a right angle to the work area.

**Purpose or Application**

A slot hood is used only for the removal of nuisance vapors or particulate. A slot hood is preferred to a canopy hood when the nuisance vapor is at room temperature.

**Reference Organization**

None

**Testing Recommendations**

Contact your Chemical Hygiene Officer for proper use of a slot hood. The manufacturer should make recommendations for the specific testing of this product including exhaust volume and smoke visualization.

**Additional Comments**

A slot hood must be positioned to receive the contaminant. Proximity to the delivering source must be considered when using a slot hood. Contact your Chemical Hygiene Officer for the proper positioning and use of a slot hood.
8.2.3 Snorkel

Examples – Elephant Trunk, Spot Collector, Extractor

Description

A small, localized ventilation hood usually connected by flexible duct to an exhaust fan.

Purpose or Application

Snorkel hoods are used for ventilating laboratory equipment and heat or nuisance vapor exhaust only.

Reference Organization

None

Testing Recommendations

Contact your Chemical Hygiene Officer for proper use of a snorkel hood. The manufacturer should make recommendations for the specific testing of this product including exhaust volume, and smoke visualization.

Additional Comments

A snorkel hood has an effective capture range of about one hood diameter away from the hood. Do not use a snorkel hood for anything but heat or nuisance vapor removal unless otherwise certified by your Chemical Hygiene Officer.

8.3 Exhausted Laminar Flow Hoods


Description

An exhausted laminar flow (ELF) hood is one that is designed for critical operations where both a clean air (class 10+) process environment is necessary, along with adequate protection to the user, from fumes and particles. ELF hoods are ventilated cabinets, which contain an integral HEPA/ULPA filtered supply air source. ELF hoods are usually 100% outside ducted, but may be recirculated in cases where particle entrapment is the principle objective. ELF hoods contain vertically closing sashes, baffle systems and often localized exhaust systems within the unit.

Purpose or Application

ELF hoods are used to protect operators from potentially hazardous fumes, typically associated with acid digestion or solvent parts cleaning, while creating clean environmental conditions required for these types of critical processes.

Reference Organization


Testing Recommendations

Because ELF hoods are hybrids between negative and positive pressure environments, strict attention to balance testing is crucial. Testing to be done against ASHRAE 110-1995 and ISO 14644-21 or most current versions.

Additional Comments

ELF hoods are often constructed in corrosion resistant materials, such as polypropylene, because of the harsh conditions often present within these critical processing environments. Further, clean room compatible materials often dictate non-shedding materials of construction. Finally, various critical processes, such as trace metals analysis, require metal-free environments, due to data collection concerns.

8.4 Biological Safety Cabinets

8.4.1 Class I Cabinets

Description

A ventilated cabinet that provides personnel and environmental protection. It is characterized by an unrecirculated inward flow of air away from the operator through a limited fixed access opening. Exhaust air must be HEPA filtered if recirculated back into the laboratory. It may or may not be vented via a remote ventilation system. This cabinet does not offer product protection.
Purpose or Application
Personnel and environmental protection.

Reference Organization
NSF International provides some information in NSF Standard 49. (See: NSF49-2002 Class II (Laminar Flow) Biohazard Cabinetry, NSF International)

Testing Recommendations
None

Additional Comments
There are no nationally recognized specifications/standards governing construction and performance for these configurations.

8.4.2 Class II Cabinets

Description
A ventilated cabinet that provides personnel, product and environmental protection. It is characterized by a limited fixed inward airflow access opening that provides personnel protection, a vertical downward HEPA filtered work zone that provides product protection and HEPA filtered exhaust providing environmental protection. They are divided into types by NSF and identified in Standard 49.

- Class II Type A1 cabinets
  (Formerly designated Type A)
  Minimum of 75 FPM (.36m/s) infl ow. HEPA filtered down flow mixed with recycled air.
  May exhaust some or all HEPA filtered air back into the laboratory.
  May have positive pressure duct systems.

- Class II Type A2 Cabinets
  (Formerly designated Type B3)
  Minimum of 100 FPM (.5m/s) infl ow. HEPA filtered, largely uncontaminated recirculated air.
  Exhausts most contaminated air to atmosphere through a dedicated duct system.
  Has negative pressure duct system or surrounded by a negative pressure duct system.

- Class II Type B1 Cabinets
  Minimum of 100 FPM (.5m/s) infl ow. HEPA filtered, largely uncontaminated recirculated air.
  Exhausts most contaminated air to atmosphere through a dedicated duct system.
  Has negative pressure duct system or surrounded by a negative pressure duct system.

- Class II Type B2 Cabinet (Total Exhaust)
  Minimum of 100 FPM (.5m/s) infl ow.
  HEPA filtered, non-recirculated, down flow air.
  HEPA filtered exhaust air to atmosphere.
  Has negative pressure duct system or surrounded by a negative pressure duct system.

Purpose or Application
Refer to the Center for Disease Control (CDC) and the National Institute of Health (NIH) for application information. (Center for Disease Control and Prevention, 1600 Clifton Rd. Atlanta, GA 30333 www.cdc.gov, National Institutes of Health, Bethesda, MD, 20892 www.nih.gov)

Reference Organization
NSF International Standard No. 49.

Testing Recommendations
Construction and Performance Specifications for Class II cabinets are defined by the NSF International Standard No. 49.
8.4.3 Class III Cabinets

Examples: Glove Box

Description

Provides absolute personnel protection, environmental protection and may provide product protection. It is characterized by a totally enclosed, gas-tight, negative pressure, HEPA filtered, ventilated workspace accessed through attached rubber gloves and purged interchange chambers. Exhaust air is treated by double HEPA filtration and/or incineration.

Purpose or Application

Testing Recommendations

None

Reference Organization

The American Glove Box Society. (The American Glove Box society is a relevant organization and is listed in section 11.0 of this document.

Reference Organization

(USA) SEFA 9-2010;

(Canada) CAN CSA Z316.5 Performance Standard.

(France) AFNOR NFX 15-211 Performance Standard.

(England) BSI Specification for recirculatory filtration fume cupboards.

(Germany) DIN 12927 Laboratory Furniture – Ductless filtering fume enclosures.

(Australia) AS2243.9 Approved Code of Practice on Safety in Laboratories - Recirculating Fume Cabinets (Ductless Fume Cabinets)

8.5 Ductless Hoods

(See: SEFA 9-2010 Recommended Practices for Ductless Enclosures)

A ductless hood recirculates air back into the laboratory from the hood chamber.

Examples: Ductless Fume Hoods, Ductless Fume Cabinets

Description

A ductless hood is an open faced enclosure designed to protect the user from laboratory and industrial airborne contaminants, similar to a laboratory fume hood, but is not connected to a duct system (although options are available for connecting to a duct system). Instead, the air is recirculated back to the room atmosphere. The ductless hood’s scope of use is limited to the capacity and capability of the filtration system. The objective of the filtration system is to reduce the levels of solids, gaseous or vapor constituent to that below the acceptable TLV limit at the exhaust.

The benefits of a ductless hood include:
Low installation cost
Portability
No permit for exhausting outside the building

Reference Organization

(USA) SEFA 9-2010;

(Canada) CAN CSA Z316.5 Performance Standard.

(France) AFNOR NFX 15-211 Performance Standard.

(England) BSI Specification for recirculatory filtration fume cupboards.

(Germany) DIN 12927 Laboratory Furniture – Ductless filtering fume enclosures.

(Australia) AS2243.9 Approved Code of Practice on Safety in Laboratories - Recirculating Fume Cabinets (Ductless Fume Cabinets)

9.0 Terms and Definitions

A&E – The “Architect and Engineer.” Generic term refers to designers of laboratory building and ventilation systems.
ACFM – Actual cubic feet per minute of gas opening.

ACGIH – The American Conference of Governmental Industrial Hygienists; association supports or produces TLV list, Industrial Ventilation Manual, bioaerosol documents.

ACH, AC/H (air changes per hour), N – The number of times air is theoretically replaced during an hour.

Acceptable Indoor Air Quality – Air in which there are no known contaminants at harmful levels as determined by appropriate authorities and air with which 80% or more of the people do not express dissatisfaction.

Access Opening – That part of the fume hood through which work is performed; sash or face opening.

Air Flow Monitor — Device installed in a fume hood to monitor the airflow through the fume chamber of a fume hood

Air Foil — A horizontal member across the lower part of the fume hood sash opening. Shaped to provide a smooth airflow into the chamber across the worksurface.

Air Volume — Quantity of air expressed in cubic feet (ft³) or cubic meters (m³).

Auxiliary Air — Supply or supplemental air delivered to a laboratory fume hood to reduce room air consumption.

Baffle — Panel located across the rear wall of the fume hood chamber interior and directs the airflow through the fume chamber.

Bench Hood – A fume hood that is located on a work surface. (See superstructure)

Bypass – Compensating opening in a fume hood that functions to limit the maximum face velocity as the sash is raised or lowered.

Combination Hood – A fume hood assembly containing a bench hood section and a floor mounted section.

Combination Sash – A fume hood sash with a framed member that moves vertically housing two or more horizontal sliding transparent viewing panels.

Counter Top – (See Work surface)

Cross Drafts – Air draft that flows parallel to or across the face opening of the fume hood.

Damper – Device installed in a duct to control airflow volume.

Diversity – Operating a system at less capacity than the sum of peak demand (ANSI Z9.5)

Duct – Round, square or rectangular tube used to enclose moving air.

Duct Velocity – Speed of air moving in a duct, usually expressed in feet per minute (fpm) or meters per second (mps).

Exhaust Collar – Connection between duct and fume hood through which all exhaust air passes.

Exhaust Unit – Air moving device, sometimes called a fan, consisting of a motor, impeller and housing.

Face – Front access or sash opening of laboratory fume hood. Face opening measured in width and height. See sash or access opening.

Face Velocity – Average speed of air flowing perpendicular to the face opening and into the fume chamber of the fume hood and expressed in feet per minute (fpm), measured at the plane of the face or sash opening.

Fan – Air moving device, usually called an exhaust unit, consisting of a motor, impeller and housing.

Fan Curve – A curve relating pressure vs. volume flow rate of a given fan at a fixed fan speed (rpm).

Filter – Device to remove particles from air.

Friction Loss – The static pressure loss in a system due to friction between moving air and the duct wall; expressed as inches w. g. 100 feet, or fractions of VP per 100 feet of duct.
Fume Chamber – The interior of the fume hood measured width, depth and height constructed of material suitable for intended use.

Fume Cupboard – British term for laboratory fume hood.

Fume Removal System – A fume hood exhaust engineered to effectively move air and fumes consistently through fume hood, duct and exhaust unit.

Gauge Pressure – The difference between two absolute pressures, one of which is usually atmospheric pressure; mainly measured in inches water gauge (in. w.g.).

Glove Box – Total enclosure used to confine and contain hazardous materials with operator access by means of gloved portals or other limited openings; this device is not a laboratory fume hood.

Grille – A louvered or perforated face over an opening in an HVAC system.

Hood – A device which encloses, captures, or receives emitted contaminants.

Hood Entry Loss – The static pressure loss, stated in inches w.g., when air enters a duct through a hood. The majority of the loss is usually associated with a vena contracta formed in the duct.

Hood Static Pressure – The sum of the duct velocity pressure and the hood entry loss; it is the static pressure required to accelerate air at rest outside the hood into the duct at duct velocity.

HVAC – Heating Ventilating and Air Conditioning. Ventilation systems designed primarily for temperature, humidity, odor control, and air quality.

Inches of Water (inch w.g.) – The pressure exerted by a column of water one inch in height at a defined reference condition such as 39°F or 4°C and the standard acceleration of gravity.

Indoor Air Quality (IAQ) – The study, evaluation, and control of indoor air quality related to temperature, humidity, and airborne contaminants.

Industrial Ventilation (IV) – The equipment or operation associated with the supply or exhaust of air, by natural or mechanical means, to control occupational hazards in the industrial setting.

Laboratory – The net assignable area in which diverse mechanical services and special ventilation systems are available to control emissions and exposures from chemical operations.

Laboratory Fume Hood – See definition in Section 3.0.

Laboratory Module – A basic unit of space usually accommodating a two person laboratory operation.

Laboratory Ventilation – Air moving systems and equipment which serve laboratories.

Laminar Flow (Also Streamline Flow) – Airflow in which air molecules travel parallel to all other molecules; flow characterized by the absence of turbulence.

Laminar Flow Cabinet – Name applied to clean bench or biological enclosures. This device is not a laboratory fume hood.

Liner – Interior lining used for side, back and top enclosure panels, exhaust plenum and baffle system of a laboratory fume hood.

Local Exhaust Ventilation – An industrial ventilation system that captures and removes emitted contaminants before dilution into the workplace ambient air can occur.

Loss – Usually refers to the conversion of static pressure to heat in components of the ventilation system, viz., “the hood entry loss.”

Low Flow Laboratory Fume Hoods – Fume Hood designs that provide a reduction in the required exhaust air volume, when compared to the volume required for the same size fume hood to operate with a face velocity of 100 FPM through a fully opened vertical sash.
Low Velocity Laboratory Fume Hoods – Fume Hood designs that provide a reduction in the required exhaust air volume, when compared to the volume required for the same size fume hood to operate with a face velocity of 100 FPM through a fully opened vertical sash and provides containment levels equivalent or superior to ASHRAE 110 tracer gas test ratings of 4.0 AM 0.05, and 4.0 AI/AU 0.10, with a face velocity of 70 FPM or less through the fully opened vertical sash. Low Velocity Fume Hoods are also referred to as High Performance Fume Hoods and High Efficiency Fume Hoods.

Make-up Air – (See Replacement and Compensating Air) Air needed to replace the air taken from the room by laboratory fume hood(s) and other air exhausting devices.

Manometer – A device which measures pressure difference; usually a u-shaped glass tube containing water or mercury.

Microorganism – A microscopic organism, usually a bacterium, fungus, or protozoan.

Minimum Transport Velocity (MTV) – The minimum velocity which will transport particles in a duct with little settling; the MTV varies with air density, particulate loading, and other factors.

Natural Ventilation – The movement of outdoor air into a space through intentionally provided openings, such as windows, doors, or other non-powered ventilators, or by infiltration.

Occupied Zone – The region within an occupied space between 3” and 72” above the floor and more than two feet from the walls for fixed air conditioning equipment. (From ASHRAE Standard 55-1981).

Odor – A quality of gases, vapors, or particles which stimulates the olfactory organs; typically unpleasant or objectionable.

Outdoor Air (OA) – “Fresh” air mixed with return air (RA) to dilute contaminants in the supply air (SA).

Particulate Matter – For these Recommended Practices, small lightweight particles that will be airborne in low-velocity air [approximately 50 fpm (.25m/s)].

Pitot Tube – A device used to measure total and static pressures in an air stream.

Plenum - A low velocity chamber used to distribute static pressure throughout its interior.

Plenum Chamber – Chamber used to equalize airflow.

Pressure Drop – The loss of static pressure between two points; for example, “The pressure drop across an orifice is 2.0 inches w.g.”

Register – A combination grille and damper assembly.

Relative Humidity (RH) – The ratio of water vapor in air to the amount of water vapor air can hold at saturation. A “RH” of 100% is about 2.5% water vapor in air, by volume.

Replacement Air – (Also, compensating air, make-up air) Air supplied to a space to replace exhausted air.

Respirable Particles – Those particles in air which penetrate into and are deposited in the nonciliated portion of the lung.

Return Air – Air which is returned from the primary space to the fan for recirculation. Room Air – That portion of the exhaust air taken from the room.

SCFM (Standard Cubic Feet Per Minute) – Airflow rate at standard conditions; dry air at 29.92 inches Hg gauge, 70 degrees F.

Sash – A moveable panel or door set in the access opening/hood entrance to form a protective shield and to control the face velocity of air into the hood.

Scrubber, Fume – A device used to remove contaminants from fume hood exhaust, normally utilizing water.

Service Fixture – Item of laboratory plumbing mounted on or fastened to laboratory fume hood.
Sulfur Hexafluoride (SF6) - Tracer gas widely used for ASHRAE testing.

Slot Velocity – The average velocity of air through a slot. It is calculated by dividing the total volume flow by the slot area; usually $v_s = 2,000$ fpm.

Smoke Candle – Smoke producing device used to allow visual observation of airflow.

Spot Collector – A small, localized ventilation hood usually connected by a flexible duct to an exhaust fan. This device is not a laboratory fume hood.

Stack – The device on the end of a ventilation system, which disperses exhaust contaminants for dilution by the atmosphere.

Standard Air — Standard Conditions STP Dry air at 70 degrees F, 29.92 in Hg.

Static Pressure (SP) – The pressure developed in a duct by a fan; SP exerts influence in all directions; the force in inches of water measured perpendicular to flow at the wall of the duct; the difference in pressure between atmospheric pressure and the absolute pressure inside a duct, cleaner, or other equipment.

Static Pressure Loss – Measurement of resistance created when air moves through a duct or hood, usually expressed in inches of water.

Suction Pressure – See Static Pressure (Archaic. Refers to static pressure on upstream side of fan.)

Superstructure – That portion of a laboratory fume hood that is supported by the work surface.

Supplemental Air – Supply or auxiliary air delivered to a laboratory fume hood to reduce room air consumption.

Thermal Anemometer – A device for measuring fume hood face velocity utilizing the principle of thermal cooling of a heated element as the detection element.

Threshold Limit Value – Time Weighted Average (TLV-TWA) – The time weighted average concentration for a normal 8-hour workday or 40-hour work week, to which nearly all workers may be repeatedly exposed, day after day, without adverse effect.

Titanium Tetrachloride – Chemical that generates white fumes used in testing laboratory fume hoods.

Total Pressure (TP) - The pressure exerted in a duct as the sum of the static pressure and the velocity pressure.

Total Suspended Particulate Matter – The mass of particles suspended in a unit volume of air (typically one cubic meter) when collected by a high-volume sampler.

Transport Velocity – Minimum speed of air required to support and carry particles in an air stream.

Turbulent Flow – Airflow characterized by transverse velocity components, as well as velocity in the primary direction of flow in a duct; mixing velocities.

TWA (Time Weighted Average) – The average exposure at the breathing zone.

Variable Air Volume (VAV) – In HVAC system, the supply air volume is varied by dampers or fan speed controls to maintain the temperature; in hoods, the exhaust air is varied to reduce the amount of air exhausted.

Velocity Pressure – Pressure caused by moving air in a laboratory fume hood or duct, usually expressed in inches of water.

Velocity (V) – The time rate of movement of air; feet per minute.

Volume Flow Rate (Q) – The quantity of air flowing in cubic feet per minute, cfm, scfm, acfm.

Work Space – The part of the fume hood interior where apparatus is set up and fumes are generated. It is normally confined to a space extending from six inches (15.2 cm) behind the plane of the sash(es) to the face of the baffle, and extending from the work surface to a plane parallel with the top edge of the access opening.
**Work Surface** – The surface that a laboratory fume hood is located on and supported by a base cabinet. In the fume chamber, the surface is recessed to contain spills.

**10.0 Basic Calculations**

An excellent source for engineering principles of ventilation can be found in Industrial Ventilation, a manual of recommended practice. This manual is prepared by the American Conference of Governmental Industrial Hygienists. The manual (27th Edition) is available for purchase from the ACGIH website acgih.org. It highlights the general principles of ventilation (including basic calculation) supply systems, exhaust systems, principles of airflow, fans, construction guidelines, and testing of ventilation systems.

This manual should be used in concert with the SEFA Recommended Practices.

**11.0 Relevant Organizations**

SEFA recognizes and acknowledges the importance of government agencies that produce documents concerning laboratory ventilation, laboratory fume hoods and laboratory safety. These agencies include:

- **AABC**  
  Associated Air Balance Council  
  1000 Vermont Avenue, NW  
  Washington, DC 20001  
  www.aabc.com

- **ACGIH**  
  American Conference of Governmental Industrial Hygienists  
  1330 Kemper Meadow Drive  
  Cincinnati, Ohio 45240  
  www.acgih.org  
  http://www.acgih.org  
  (513) 742-2020

- **AGA**  
  American Gas Association  
  1515 Wilson Blvd.  
  Arlington, VA 22209  
  www.aga.com

- **AGC**  
  Associated General Contractors of America  
  1957 E. Street, NW  
  Washington, DC 20006  
  www.agc.org

- **AGS**  
  American Glove Box Society  
  P. O. Box 9099  
  Santa Rosa, CA 95405  
  www.gloveboxsociety.org  
  (800) 530-1022

- **AHA**  
  American Hardboard Association  
  1210 W. Northwest Highway  
  Palatine, IL 60067-1897  
  www.domensino.com/aha/  
  (847) 934-8800

- **AIA**  
  The American Institute of Architects  
  1735 New York Avenue, NW  
  Washington, DC 20006-5292  
  www.aia.org  
  (202) 626-7300

- **AIHA**  
  American Industrial Hygiene Association  
  2700 Prosperity Ave., Suite 250  
  Fairfax, VA 22031  
  www.aiha.org  
  (703) 849-8888

- **AMCA**  
  Air Movement & Control Association International, Inc.  
  30 W. University Drive  
  Arlington Heights, IL 60004-1893  
  www.amca.org  
  (847) 394-0150

- **ANSI**  
  American National Standards Institute  
  11 West 42nd Street 13th Floor  
  New York, NY 10036-8002  
  www.ansi.org  
  (888) 267-4683  
  (212) 642-4900
AHRI  Air Conditioning, Heating, and Refrigeration Institute  
4301 Fairfax Drive, Suite 425  
Arlington, VA  22203  
www.ari.org  
(703) 524-8800  

ASCE  American Society of Civil Engineers  
World Headquarters  
1801 Alexander Graham Bell Drive  
Reston, VA  20191-4400  
www.asce.org  
(800) 548-2723  
(703) 295-6000  

ASCET  American Society of Certified Engineering Technicians  
P. O. Box 1348  
Flowery Branch, GA  30548  
www.ascet.org  
(777) 967-9173  

ASHRAE American Society of Heating, Refrigerating and Air Conditioning Engineers  
1791 Tullie Circle, NE  
Atlanta, GA  30329-2305  
www.ashrae.org  
(800) 527-4723  
(404) 636-8400  

345 East 47th Street  
New York, NY  10017-2392  
www.asme.org  
(800) 843-2763 (US and Canada)  
011-(800)-843-2763 (Mexico)  
(973)822-1170 (Outside NA)  

ASPE  American Society of Plumbing Engineers  
3617 Thousand Oaks Blvd., Suite 210  
Westlake Village, CA  91362-3649  
www.aspe.org  
(805) 495-7120  

ASSE  American Society of Sanitary Engineering  
28901 Clemens Road  
Westlake, OH  44145  
www.asse-plumbing.org  
(440) 835-3040  

ASTM  American Soc of Testing & Materials  
100 Barr Harbor Drive  
West Conshohocken, PA  19428-2959  
www.astm.org  
(610) 832-9500  

BSI  British Standards Institution  
389 Chiswick High Road  
London  W4 4AL United Kingdom  
www.bsi-global.com  
+44 (0)20 8996 9000  

CALOSHA California Division of Occupational Safety and Health  
455 Golden Gate Avenue  10th Floor  
San Francisco, CA  94102  
www.dir.ca.gov/dosh  
(800) 963-9424— (916) 274-5721  

CDC  Center for Disease Control and Prevention  
1600 Clifton Road  
Atlanta, GA  30333  
www.cdc.gov  
(404) 639-3311  

CSI  Construction Specification Institute  
99 Canal Center Plaza, Suite 300  
Alexandria, VA  22314  
www.csinet.org  
(800) 689-2900  

CETA Controlled Environmental Testing Association  
1500 Sunday Drive, Suite 102  
Raleigh, NC  27607  
www.cetainternational.org  

CSA  Canadian Standards Association  
5060 Spectrumway, Suite 100  
Mississauga, Ontario L4W 5N6  
www.csa.ca  
(800) 463-6727  

DIN  German National Standard  
DIN Deutsches Institut für Normung e. V.  
10772 Berlin, Germany  
www.din.de
12.0 Regulatory and Industry Consensus Standards

The potential for chemical exposure of personnel in laboratories has resulted in the promulgation of a wide variety of standards for ensuring proper operation of laboratory fume hood systems. The requirements and value of the information contained in the different standards will vary depending on your responsibilities.

A few of the relevant standards are briefly described below.

12.1 (ACGIH) American Conference of Governmental Industrial Hygienists

The ACGIH produces a wide variety of useful literature; however, two particularly useful guides are the Threshold Limit Values for Chemical Substances and Physical Agents and Biological Exposure Indices (TLV Guide) and the Industrial Ventilation: A Manual of Recommended Practice. The TLV Guide provides an excellent source of guidelines to assist with control of occupational hazards.

The Industrial Ventilation Manual provides one of the best sources of information on hood and ventilation system design.

(ACGIH) Industrial Ventilation (24th Edition) p. 10-40 “Supply Air Distribution – For typical operations at a laboratory fume hood, the worker stands at the face of the hood and manipulates the apparatus in the hood. The indraft at the hood face creates eddy currents around the worker’s body, which can drag contaminants in the hood back to the body and up to the breathing zone. The higher the face velocity, the greater the eddy currents. For this reason, higher face velocities do not result in as much greater protection as might be supposed.”

p. 10-40 “Selection of Hood Face Velocity – The interaction of supply air distribution and hood face velocity makes any blanket specification of hood face velocity inappropriate. Higher hood face velocities will be wasteful of energy and may provide no better or even poorer worker protection.”

“For projected new building, it is frequently necessary to estimate the cost of air conditioning
early, before the detailed design and equipment specification are available. For that early estimating, the following guidelines can be used. Hoods near doors are acceptable if 1) there is a second safe egress from the room, 2) traffic past hood is low, and 3) door is normally open.

### 12.2 ANSI/AIHA Z9.5 – 1992

The American National Standards Institute (ANSI) published Z9.5 An American National Standard for Laboratory Ventilation, “to provide guidance in the selection, design, operation and use of laboratory ventilation system.”

This standard is best suited for health and safety and engineering personnel responsible for ensuring proper use and design of laboratory fume hood systems.

The standard provides non-regulatory guidelines and recommendations. It is the responsibility of an organization to determine the applicability of the recommendations.

A few of the recommendations include:

- Develop a Laboratory Ventilation Management Program (LVMP). The program should include specific procedures for ensuring proper selection, design, operation, maintenance and use of laboratory fume hood systems.
- Designate a cognizant person to administer the LVMP. Maintain Permanent Records of Performance.
- Conduct initial and routine system performance tests.
- The ASHRAE 110 Test is the preferred test for initial evaluation of performance.
- Routine performance tests should be conducted at least annually or whenever a significant change in the hood system occurs.
- New and renovated hoods must be equipped with flow measurement devices.
- Supply air velocities (cross drafts) should be limited to less than 50% of target face velocity near hood openings.
- The ductwork must be compatible with chemical effluents, sized to ensure 2,000 fpm duct velocities and designed to ensure safe transport and exhaust of materials generated in the hood. All ducts should be under negative pressure within the building.
- The sound pressure level of noise should be limited at worker locations to below 85 dBA. Room noise should be limited to below a noise criterial curve rating of 55 dBA.
- The catastrophic potential of each laboratory should be determined.
- Lab personnel should be trained in proper work practices.
- Further recommendations are provided for design and use of bypass fume hoods, VAV

<table>
<thead>
<tr>
<th>Condition</th>
<th>CFM/Sq.Ft. Open Hood Face</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ceiling panels properly located with average panel face velocity &lt;60 fpm. Horizontal-sliding sash hoods. No equipment in hood closer than 12 inches to face of hood. Hoods located away from doors and traffic ways.</td>
<td>60</td>
</tr>
<tr>
<td>Same as above; some traffic past hoods. No equipment in hoods closer than six inches to face of hood. Hoods located away from doors and traffic ways.</td>
<td>80</td>
</tr>
<tr>
<td>Ceiling panels properly located with average panel face velocity &lt;60 fpm or ceiling diffusers properly located; no diffusers immediately in front of hoods; quadrant facing hood blocked, terminal throw velocity &lt;50 fpm. No equipment in hood closer than six inches to face of hood. Hoods located away from doors or traffic ways.</td>
<td>80</td>
</tr>
<tr>
<td>Same as three above; some traffic past hoods. No equipment in hoods closer than six inches to face of hood.</td>
<td>100</td>
</tr>
</tbody>
</table>
Discourage the use of a numerical pressure differential between rooms as a basis for design. Although it is true that the difference in pressure is the driving force that causes airflow through any openings from one room to another, specifying quantitative pressure differential is a poor basis for design. What is really desired is an offset air volume. Attempts to design using direct pressure differential measurement and control vs. controlling the offset volume results in either short or extended periods of the loss of pressure when the doors are open or excessive pressure differentials when doors are closed, sufficient to affect the performance of low pressure fans. The direct pressure control systems are also hard to stabilize, and can cause building pressure problems and result in excessively large volume offsets in porous rooms. The need to maintain directional airflow at every instant and the magnitude of airflow needed will depend on individual circumstances. For example, “clean” rooms may have very strict requirements while teaching laboratories may only need to maintain directional airflow during certain activities or emergency conditions. In the later cases, one would simply use the appropriate offset to maintain directional airflow as needed and operational procedures during emergencies (i.e., close doors during a chemical spill).

The amount of offset should be based on two considerations:

The airflow required to keep the room negative (or in some positive) with regard to surrounding air spaces. The 10% offset suggested in the comments may be appropriate in some cases, but has no general validity.

The required “stringency” of the requirement for direction of airflow into or out of any openings in the walls. If the requirement is stringent, two seldom considered factors become important. First, if there is any appreciable temperature difference between the lab and the adjoining space, when a door is opened there will be a thermal exchange of warmer air flowing in one direction at the top of the doorway, and cooler air flowing in an opposite direction near the floor. An airflow velocity of at least 40 fpm is required to inhibit this exchange under normal conditions, a flow rate of 100 fpm is more positive. If there is no airlock, and if there is a definite but not stringent need for direction of airflow, this phenomenon should be made a design consideration.

For situations less than those requiring stringent control, VAV systems should be adequate. The offset volume should be based on the cfm needed to provide at least 50 cfm, (100 fpm is better) through the doorway opening. The increased offset volume can be operated by a mechanical optical switch at or near the door. The volume of offset air required is not related to the ventilation rate of the laboratory.

12.3 ANSI / ASHRAE 110 – 1995

The American Society of Heating, Refrigeration and Air Conditioning Engineers’ ANSI / ASHRAE 110 Method of Testing Performance of Laboratory Fume Hoods provides guidelines to conduct qualitative tests to evaluate hood performance and quantitative tests to measure air velocities and containment capability.

The standard is best suited for persons responsible for ensuring proper operation of laboratory fume hoods, typically health and safety, engineering and maintenance.

The standard provides methods for:

Inspecting the hood and operating environment.

Airflow visualization (smoke tests).

Measurement of face velocity.

Tracer gas containment tests.

Limited evaluation of variable air volume operation.

Suggested tests for evaluating dynamic conditions (worker movement, traffic past the hood, etc.).
The standard also describes three methods of specifying the tests:

"As Manufactured" (AM) Tests - AM tests are conducted at the manufacturer's facility to evaluate hood design. AM tests enable pre-purchase evaluation of hood performance and provide critical operating specifications required for proper design of laboratory ventilation systems.

"As Installed" (AI) Tests – AI tests are conducted after experimental apparatus have been placed in the hood. The tests are used to determine hood limitations and the need for special work practices.

"As Used (AU) Tests - AU tests verify the function of the hood in the condition that the user has established the hood.

12.4   ASHRAE Handbook Applications 1999

p. 30.10
Face Velocity.
"If the face velocity (design and operation) must be maintained at 100 fpm (0.5/s) + 10%, this average may be allowed to deteriorate to 85 fpm (0.47 m/s) before correction and then the face velocity must be returned to 100 fpm (0.5/s). Individuals reading may not vary more than + 15% with the hood empty or + 25% with research equipment in the hood.

p. 30.5
"All laboratory fume hoods and safety cabinets should be equipped with visual and audible alarms to warn the laboratory workers of unsafe airflow."

p. 13.11
"In order for the laboratory to act as a secondary confinement barrier …, it must be maintained at a slightly negative pressure with respect to adjoining areas to contain odors and fumes. Exceptions are sterile facilities of clean spaces that may need to be maintained at a positive pressure with respect to adjoining spaces."

12.5   NFPA 45, 2000

p. 5-12
"6.4.5. Laboratory fume hood velocities and exhaust volumes shall be sufficient to contain contaminants generated within the hood and exhaust them outside of the laboratory building. The hood shall provide confinement of the possible hazards and protection for personnel at all times when chemicals are present in the hood."

p. 45 – 28
Appendix "A-6.4.6. Laboratory fume hood containment can be evaluated using the procedures contained in the ASHRAE 110, Method of Testing Performance of Laboratory Fume Hoods. Face velocities of 0.4 m/sec to 0.6 m/sec (80 fpm to 120 fpm) generally provide containment if the hood location requirements and laboratory ventilation criteria of this standard are met."

p. 45 – 13
A measuring device for hood airflow shall be provided on each laboratory hood. The measuring device for hood airflow shall be a permanently installed device and shall provide constant indication to the hood user of adequate or inadequate hood airflow.

p. 45 – 12, Sections 6.3.3, 6.4.1
"Laboratory units in which chemicals are present shall be continuously ventilated. Air exhausted from laboratory fume hoods and other special local exhaust systems shall not be recirculated."

Differential pressure control versus volumetric offset – Room pressurization has been approached using two different methods:

Differential pressure control, and Volumetric offset control.

12.6   OSHA 1910.1450

In 1990, The Occupational Safety and Health Administration (OSHA) published 29 CFR Part 1910.1450 Occupational Exposure to Hazardous Chemicals in Laboratories (Federal Register, Volume 55, No. 21 pages 3327-3335). The standard became effective May 1, 1990 and
contains a variety of regulatory requirements and recommendations for laboratories.

The law requires that laboratory facilities have a written Chemical Hygiene Plan that ensures protection for laboratory personnel, proper operation of laboratory fume hood systems and training of all laboratory personnel in safe work practices.

Chemical Hygiene Plan (CHP)

With few exceptions, all laboratories must develop a written CHP.

The standard requires designation of a Chemical Hygiene Officer.

The Chemical Hygiene Officer must develop, implement and administer the CHP.

The CHP must be capable of preventing overexposure of laboratory personnel to all potential chemical hazards.

The CHP must be readily available to all employees.

The CHP must include:

- Protocols for identifying hazardous procedures.
- Standard Operating Procedures for working with hazardous chemicals
- Basis for selection of appropriate exposure control methods.
- Measures to assure proper functioning of laboratory fume hoods.
- Methods to evaluate system operation upon installation and routinely (recommended quarterly).
- The standard recommends installation of monitors on all hoods.
- Requires training and dissemination of employee information on all potential hazards.

Federal Register – OSHA
p. 3332. Paragraph G, Quality
“…airflow into and within the hood should not be excessively turbulent.” (200)
“…hood face velocity should be adequate (typically 60 – 100 lfm).” (200,204)
Note: Reference to page numbers in Prudent Practices for Handling Hazardous Chemicals in Laboratories are given in parenthesis i.e., (200)

p. 484. Paragraph (B) Hoods
“…each hood should have a continuous monitoring device to allow convenient confirmation of adequate hood performance before use (200, 203).”

p. 484
“4. Ventilation … direct air flow into the laboratory from non-laboratory areas and out to the exterior of the building …”

12.7 Prudent Practices


p. 178
“In most cases, the recommended face velocity is between 80 and 100 feet per minute (fpm). Face velocities between 100 and 120 fpm may be used for substances of very high toxicity or where outside influences adversely affect hood performance. However, energy costs to operate the fume hood are directly proportional to the face velocity. Face velocities approaching or exceeding 150 (fpm) should not be used, because they may cause turbulence around the periphery of the sash opening and actually reduce the capture efficiency of the fume hood.”

p. 192
“In all cases, air should flow from the offices, corridors, and support spaces into the laboratories. All air from chemical laboratories should be exhausted out-doors and not recirculated. Thus, the air pressure in chemical laboratories should be negative with respect to the rest of the building unless the laboratory is also a clean room.”
2. Hoods should be evaluated before use to ensure adequate face velocity (typically 60 – 100 lfm) …and the absence of excessive turbulence…

If the hood and the general ventilating system are properly designed, face velocities in the range of 60 – 100 fpm will provide a laminar flow of air over the floor and sides of the hood. Higher face velocities (125 fpm or more), which exhaust the general laboratory air at a greater rate, are both wasteful of energy and likely to degrade hood performance by creating air turbulence at the hood face and within the hood. Such air turbulence can cause the vapors within the hood to spill out into the general laboratory atmosphere.

The optimum face velocity of a hood (also called the capture velocity) will vary depending on its configuration. As noted above, too high a face velocity is likely to increase the turbulence within the hood and cause gases or vapors to spill from the hood into the room.

Make sure that a continuous monitoring device for adequate hood performance is present and check it every time the hood is used.

After the face velocity of each hood has been measured (and the airflow balanced if necessary), each hood should be fitted with an inexpensive manometer or other pressure – measuring device (or a velocity-measuring device) to enable the user to determine that the hood is operating as it was when evaluated. This pressure measuring device should be capable of measuring pressure differences in the range of 0.1-2.0 in. of H20 and should have the lower pressure side connected to the duct above the hood and the higher pressure side open to the general laboratory atmosphere.

12.8 Handbook of Laboratory Safety

If there are administrative, classroom, or service areas within the same building as laboratories, the entire laboratory area should be at a modest negative pressure with respect to these spaces so that any airflow that exists will be from the non-research areas into the space occupied by laboratories.

…the design of the air exhaust system from a laboratory must be done carefully to provide continuing replacement of fresh air in the room. The fume hood system and the supplementary exhaust system should be interlocked to ensure a stable room air balance at all times.

Please refer to the latest editions for all reference materials.
Scientific Equipment & Furniture Association
Recommended Practices

SEFA 2 - 2010
Installations
Table Of Contents

<table>
<thead>
<tr>
<th>Page</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Committee Members</td>
<td>104</td>
</tr>
<tr>
<td>Foreword</td>
<td>105</td>
</tr>
<tr>
<td>1.0 Scope</td>
<td>106</td>
</tr>
<tr>
<td>2.0 Purpose</td>
<td>106</td>
</tr>
<tr>
<td>3.0 Definitions</td>
<td>106</td>
</tr>
<tr>
<td>4.0 Job Site Conditions</td>
<td>107</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>4.1 Site Access</td>
<td></td>
</tr>
<tr>
<td>4.2 Building Finish</td>
<td></td>
</tr>
<tr>
<td>4.2.1 Floors</td>
<td></td>
</tr>
<tr>
<td>4.2.2 Wall System</td>
<td></td>
</tr>
<tr>
<td>4.2.3 Ceiling System</td>
<td></td>
</tr>
<tr>
<td>4.2.4 Branch Electrical Circuits</td>
<td></td>
</tr>
<tr>
<td>4.2.5 Air Conditioning Grilles</td>
<td></td>
</tr>
<tr>
<td>4.2.6 Overhead Electrical Fixtures</td>
<td></td>
</tr>
<tr>
<td>4.2.7 Overhead Mechanical Lines</td>
<td></td>
</tr>
<tr>
<td>4.2.8 Service Lines</td>
<td></td>
</tr>
<tr>
<td>4.2.9 Environmental Conditions</td>
<td></td>
</tr>
<tr>
<td>4.2.10 Power Requirements</td>
<td></td>
</tr>
<tr>
<td>5.0 Receiving, Distribution, Storage and Security</td>
<td>108</td>
</tr>
<tr>
<td>5.1 Delay of Installation</td>
<td></td>
</tr>
<tr>
<td>5.2 Distribution/Storage of Equipment</td>
<td></td>
</tr>
<tr>
<td>5.3 Security</td>
<td></td>
</tr>
<tr>
<td>6.0 General Conformance to Building Specifications</td>
<td>109</td>
</tr>
<tr>
<td>7.0 Continuity and Cooperation With Other Trades</td>
<td>109</td>
</tr>
<tr>
<td>7.1 Scientific Equipment and Furniture Supplier (SEF Supplier)</td>
<td></td>
</tr>
<tr>
<td>7.2 Mechanical and Electrical Trades</td>
<td></td>
</tr>
<tr>
<td>7.3 Protection of Finished Surfaces</td>
<td>110</td>
</tr>
</tbody>
</table>
SEFA 2—Installations Committee Members

Co-Chairs

Ron Johnson - Haldeman Homme
Dennis Brewer - Brewer Construction Services

HEMCO Corp.
Institutional Casework
Scientific Plastics
VWR International
Foreword

SEFA Profile

The Scientific Equipment and Furniture Association (SEFA) is an international trade association comprised of manufacturers of laboratory furniture, casework, fume hoods and members of the design and installation professions. The Association was founded to promote this rapidly expanding industry and improve the quality, safety and timely completion of laboratory facilities in accordance with customer requirements.

SEFA Recommended Practices

SEFA and its committees are active in the development of Recommended Practices having domestic and international applications. Recommended Practices are developed by the association taking into account the work of other standard-writing organizations. Liaison is also maintained with government agencies in the development of their specifications.

SEFA's Recommended Practices are developed in and for the public interest. These practices are designed to promote a better understanding between designers, architects, manufacturers, purchasers, and end-users and to assist the purchaser in selecting and specifying the proper product to meet the user’s particular needs. SEFA’s Recommended Practices are periodically updated. The Recommended Practices are numbered to include an annual suffix which reflects the year that they were updated. SEFA encourages architects to specify these Recommended Practices as follows: “SEFA 2-2010”

SEFA Glossary of Terms

SEFA has developed a Glossary of Terms (SEFA 4-2010) for the purpose of promoting a greater understanding between designers, architects, manufacturers, purchasers and end users. The terms defined by SEFA are frequently used in contracts and other documents, which attempt to define the products to be furnished or the work involved. The Association has approved this Glossary in an effort to provide uniformity among those who use these terms. Where a specific Recommended Practice contains definitions which differ from those in the Glossary of Terms, then the definitions in the specific Recommended Practice should be used.

SEFA encourages all interested parties to submit additional terms or to suggest any changes to those terms already defined by the Association. The definitions should be used to help resolve any disputes that may arise or to incorporate the applicable terms in any contract or related documents.

SEFA Disclaimer

SEFA uses its best effort to promulgate Recommended Practices for the benefit of the public in light of available information and accepted industry practices. SEFA does not guarantee, certify, or assure the safety or performance of any products, components, or systems tested, installed, or operated in accordance with SEFA Recommended Practices or that any tests conducted under its Recommended Practices will be non-hazardous or free from risk. SEFA encourages the use of third party independent testing where appropriate.
1.0 Scope

These Recommended Practices are intended to provide information about the installation practices recommended by manufacturers of scientific laboratory furniture and equipment. This information is for the use by architects, specifying engineers, contractors, and other purchasers, specifiers or end users of laboratory equipment.

2.0 Purpose

SEFA offers these Recommended Practices for use by federal agencies, architects, engineers, consultants, builders, specification writers, contractors and owners who specify and/or accept scientific laboratory furniture and equipment and its installation.

This information, if used as a guide for coordination and work sequencing, will afford the owner a quality installation of furniture consistent with economic utilization of resources employed.

These Recommended Practices are not intended to override local building codes and may conflict with certain “localized” construction practice.

Note To Manufacturer: SEFA is committed to sustainability; to that end it is recommended that minimization of waste to reduce disposal problems be a priority. Some ways of doing this is by minimizing packaging, blanket wrapping of product is one method as is utilization of returnable skids and pallets. Use of recyclable products will also reduce on items going to local landfills.

3.0 Definitions

(See also SEFA 4-2010—Glossary of Terms)

Acid Storage Cabinets – Cabinets in which Acids are stored to avoid having large quantities of hazardous material in the laboratory work area. This reduces the risk of personnel injury or damage to the work area of the laboratory.

Approved – Acceptable to the authority having jurisdiction.

Authority Having Jurisdiction – An organization, office or individual responsible for enforcing the requirements of a code or standard, or for approving equipment, materials, and installation, or a procedure.

Broom Clean - A condition in an interior area in which surface debris has been removed by dry methods.

Casework – Base and wall cabinets, display fixtures, storage shelves. The generic term for both the “boxes” and special desk, reception counters, nurses station and the like. Generally includes the tops and work surfaces.

Corrosion Resistant Finishes - Corrosion resistant finishes are organic coated finishes applied to all exposed surfaces of laboratory products such as service fitting, either colored or clear. The finish can be epoxy, epoxy/polyester hybrid, or polyester.

Dilution Tank – Tank basins in which highly concentrated wastes are mixed with wastes from other laboratory areas to produce diluted solutions.

Flammable/Solvent storage cabinets – Cabinets in which heat ignitable materials are stored to prevent exposure to ignition sources and restrict access to unauthorized personnel.

Grounds/Blocking - Reinforcement within walls to provide adequate anchorage for wall-hung or secured equipment. May be wood (2x or ¾” plywood) or metal (18 ga. Steel or equivalent), or in accordance with local building code requirements.

Hazardous Storage Cabinets – General term for cabinets that restrict access to chemicals that might be harmful or dangerous to students or other personnel not qualified to have access.

These chemicals may include but are not limited to Corrosives, Acids, Bases and other chemicals found in the Laboratory

Laboratory work area – The main area of the laboratory where chemicals are used during experiments, testing or teaching.
May - When used indicates an alternate requirement or option.

Neutralization Tank – Tanks that can be charged with marble or limestone chips with a high, (90%+), calcium carbonate content. As wastes are discharged into the unit, chips will react with the acid to form less corrosive materials

Proper Authorities - The party or parties designated by contract to approve additions, changes or deletions to contracts, plans, or specifications.

Reasonably - When used indicates using fair, and sensible methods within accepted industry standards and guidelines.

Related Equipment - Items not generally manufactured by the Scientific Equipment and Furniture Supplier, (SEF supplier), but furnished and/or installed as part of the SEF supplier’s contract. These may consist of but are not limited to: instrumentation, environmental rooms, refrigeration systems, laboratory apparatus, etc.

Rough-In Point - Individual or common supply or mechanical, electrical and heating, ventilating and air conditioning through wall, floor or ceiling, located within the equipment chase.

RTV Silicone Sealant - Silicone is an organic silicon compound highly resistant to heat, water, etc. Sealant hardens when exposed to air. RTV means, “room temperature vulcanizing” and will harden or cure without a heat gun or other heat source. Will form a permanent elastic watertight and weatherproof bond to many surfaces, such as glass, ceramic, metals, painted surfaces and plastics.

Scientific Equipment and Furniture Supplier (SEF Supplier) - Manufacturer, dealer, distributor or agents who provide laboratory furniture, equipment and fume hoods.

Service Fitting and Fixture - Any device that controls and/or guides the flow of gas, air, vacuum, water, steam, oxygen etc. used in a laboratory. Also know as Laboratory Service Fittings.

Shall - Where used, indicates a mandatory requirement.
Should – Where used indicates recommendation.

Standard Tools - Tools, such as a screwdriver, key wrench, flat-jawed wrench, strap wrench and pliers, which are normally carried by tradesmen for installation and maintenance.

Vent – Ducting or piping system designed to remove or change the air in an enclosed space like storage cabinets.

4.0  Job Site Conditions

4.1  Site Access

The site roadway shall be of solid base and Shall allow motor vehicle delivery if inside storage or distribution is required, to either the outside hoist, if so required, or the tailgate delivery area. When a hoist or elevator is required, it shall be installed and made available to the SEF supplier at no charge unless otherwise specified. The receiving area in the building and corridors needed for casework and equipment shall be clear of materials of other trades to make reasonable access to elevators and distribution areas free of obstructions.

4.2  Building Finish

Upon delivery of equipment to the job site, it shall be possible to allow complete distribution and commencement of the physical installation in the rooms where the equipment is designated to be installed. In order to ensure an orderly installation and to avoid damage to finished furniture, the following degree of building finish shall be completed prior to installation of furniture and equipment:

4.2.1 Floors

Floors shall be level within 1/8” (19mm) of level per 10’ run, non-accumulative, when tested with a straight edge in any one direction. Floors that exceed this requirement will cause additional work during casework installation. Unacceptable gaps at floor and tolerances at scribes and fillers, due to this problem, which are detected during
4.2.2 Wall Systems

Wall Systems shall be completely installed and be plumbed for installation of wall cabinets. Wall system finish shall be complete, but shall include, at a minimum, a prime coat of paint, appropriate with respect to the specifications. Wall systems shall include horizontal bracing supplied and installed by others for support of wall cases, and equipment shelving as shown in submitted drawings or required by local code.

4.2.3 Ceiling System

The ceiling system shall be in a finished condition.

4.2.4 Branch Electrical Circuits

Branch electrical circuits, including grounding conductors, shall be in place.

4.2.5 Air Conditioning Grilles

Air conditioning grilles, call systems and permanent sprinklers head shall be installed.

4.2.6 Overhead Electrical Fixtures

Overhead electrical fixtures shall be installed and connected. Adequate lighting shall be available.

4.2.7 Overhead Mechanical Lines

Overhead mechanical lines shall be tested for leaks before finished furniture is installed in any area.

Where mechanical, electrical and H.V.A.C. service lines will be behind, above or under furniture installed in designated locations, service access or stubs shall be installed at the appropriate rough in point.

4.2.8 Service Lines

Service lines for water, steam, gas and special gases shall be flushed clean of dirt and chips, capped and tested for leaks prior to the connection of service fittings. It is recommended that water be available in or near the rooms where counter tops are designated to be installed.

4.2.9 Environmental Conditions

The building shall be secure and watertight. Exterior glazing and doors shall be installed providing protection from the elements and security for finished equipment and furniture. General conditions indicating readiness for delivery and installation include:

- Overhead ceiling work, ductwork, lighting, acoustical ceiling, insulation, etc. is complete.
- Air handling and control systems are functioning and relatively constant temperature and humidity conditions are being maintained through owner acceptance. Temperature and humidity ranges of 65-80°F (18-27°C) and 30-50% r.h. are recommended.

4.2.10 Power Requirements

The general contractor and/or owner shall provide, at no charge to the SEF supplier; necessary electrical service and lighting for normal installation procedures. It is recommended that electrical power be available in the rooms where equipment is designated to be installed. If temporary service must be used, service extensions shall not exceed 100 feet (30 meters) in length. Power service shall conform to OSHA requirements.

5.0 Receiving, Distribution, Storage and Security

5.1 Delay of Installation

If Installation cannot commence in a timely manner due to conditions beyond the SEF suppliers' control, casework and equipment shall be placed in temperature and humidity controlled.
storage. Additionally, costs for handling, shipping and storage shall be borne by others.

5.2 Distribution/Storage of Equipment

Distribution of the equipment shall be possible at the time of delivery. If, upon mutual agreement, earlier shipment is made and the casework is placed in temporary storage, it is to be secure from the elements, secure against damage by other trades and secure against loss.

In the case of high value items, such as service fittings, that may be shipped to the job site on larger projects and used over the course of several months of installation, a secure locked storage area shall be available to the SEF for his use to safeguard this equipment at the job site prior to distribution to the proper trades for installation.

Additional cost associated with storage, multiple handling necessitated by jobsite conditions shall be borne by the customer.

5.3 Security

Project/jobsite security and protection shall be the responsibility of the general contractor and/or the customer.

6.0 General Conformance to Building Specifications

It is intended that the work involved will be in conformance with the project specifications. When variation or conflict occurs regarding installation of equipment, the supplier shall bring the issue to the attention of the proper authorities for immediate resolution.

7.0 Continuity and Cooperation With Other Trades

7.1 Scientific Equipment and Furniture Supplier (SEF Supplier)

It shall be the responsibility of the SEF supplier or installer to cooperate with other trades. It is the responsibility of the customer to coordinate with other trades. Casework, as installed, is considered to be finished equipment and shall be respected by all trades. Liability for damage shall be borne by the damaging party. If it is indeterminable who caused the damage, it shall be the responsibility of the customer.

7.2 Mechanical and Electrical Trades

Where access is required through items of laboratory equipment, it shall be the service trades responsibility to remove said access panels/drawers, etc., where they occur, and properly replace such access panels/drawers at their own expense. The SEF supplier and the mechanical trades shall cooperate in order to maintain job continuity.

7.3 Protection of Finished Surfaces

At no time shall installed work be used by tradesmen as a workbench, scaffolding, tool storage, etc. It will be the responsibility of the other trades, (including final wall finishing), to perform minor wall touch-up and to adequately protect installed casework, especially the laboratory work surface from debris, paint and damage in the course of their operation and at their expense. At no time shall the work surfaces be walked on. The general contractor is responsible for security and protection of the completed portions of the laboratory until punch list process is complete.

8.0 Installation Procedures

8.1 Installer Qualification

The installer shall have five years of continuous experience installing laboratory equipment using professional and accepted trade practices and be familiar with SEFA’s Recommended Practices. The installer may also be certified by a Scientific Equipment and Furniture Association Member (manufacturer or dealer) that hires the installer to perform the following scope of work.
8.2 Safety

SEFA recommends that the installer use the safety equipment provided for their protection. Unsafe conditions or practices shall be reported to the supervisor immediately. Any injury, regardless of how slight, must likewise be reported to the supervisor immediately.

It is also strongly recommended that if there is any uncertainty as to the proper work procedures, the installer shall ask the assigned on site and off site installation supervisors for clarification. Guessing may endanger the installer and/or others on the job.

8.3 Casework

8.3.1 Base Cabinets

Establish the high point of the floor. From that point the first cabinets are set and made level, plumbed in relation to the high point. If conditions of the job site indicate more than the ¾-inch (19 mm) of leveling requirements between the bottom of the cabinets and the low point of the floor, an immediate notification shall be made to the proper authorities at the job site indicating this condition. Appropriate action shall be initiated promptly for correction of the discrepancy, at no cost to the SEF supplier/installer.

The cabinets shall be secured to building structure – floor/walls/ceiling in a manner to preclude inadvertent movement and be ready to receive the work surfaces as called out in the project specification. Each modular unit shall have secure contact with the floor during the leveling process by the appropriate leveling device.

8.3.2 Wall Cabinets

Establish the high point of the wall, and anchor the first cabinet at this point. If the wall surface varies more than 3/8-inch (10 mm) an immediate notification shall be made to the proper authorities at the job site pointing out this condition. Appropriate action shall be initiated promptly for correction of the discrepancy, at no cost to the SEF supplier/installer. Acceptable methods of fastening wall cabinets shall be as directed by the project specifications, or as standard and customary in order to provide a secure wall hung case capable of supporting appropriate weight loads. The structural wall system, (including grounds/blocking), shall be capable of supporting the appropriate loads.

8.3.3 Tall Cabinets

Tall units shall be appropriately leveled with respect to the floor and secured to the wall in order to prevent tipping.

8.4 Hazardous Storage Cabinets and Flammable/Solvent Storage Cabinets

An experienced laboratory equipment installer shall perform installation. Metal cabinets used for flammable storage shall be securely installed and grounded by appropriate trade when necessary; if chemicals are being dispensed directly from a cabinet then the container must also be grounded.

8.5 Cabinet Venting

8.5.1 Venting Flammable/Solvent Storage Cabinets

Although venting of flammable/solvent storage cabinets has not been demonstrated to be necessary for fire protection purposes, venting is recommended to exhaust noxious fumes that may build-up in an enclosed cabinet, and cause discomfort and/or compromise the respiratory health of laboratory personnel. For flammable storage cabinets NFPA 30 recommends the use of metal piping if the cabinet is to be vented.

When a plastic product for venting of hazardous storage cabinets is specified, it is recommended that polyolefin pipe be used. – See ASTM 1412. - PVC piping is not recommended for venting, as it will burn black if ignited and produce chlorine gas.

The cabinet should be vented from the bottom or the top depending on the reagents stored, lighter than air chemicals need vents located at the top of the cabinet. – See SEFA 11 (Liquid Chemical Storage) ¶ 4.1.3 and ¶ 4.2.3 for more specifics on cabinet venting.
8.6 Fume Hoods

8.6.1 Prior to setting a fume hood

The necessary coordination shall be accomplished between the mechanical, electrical and H.V.A.C trades to assure access is available for their work.

8.6.2 Installation

Supporting cabinets shall be set in the same manner as the base cabinets. Counter tops shall be securely fastened to the understructure, as recommended by the fume hood manufacture, and leveled. After the fume hood superstructure is set and secured, the understructure shall be checked to ensure that the leveling device remains in firm contact with the floor and the superstructure shall be checked for proper sash operation.

8.6.3 Balancing

Laboratory fume hood exhaust shall be balanced after installation by the parties designated by the contract and scope of work. Upon completion of the hood installation see SEFA 1 for any additional information on installation and testing.

8.7 Work Surfaces (Counter Tops)

Laboratory work surfaces shall be leveled and shimmed as necessary. Shims under a work surface shall generally not exceed 1/8 inch, (3 mm). Appropriate fastenings shall be made after the work surface is leveled, per manufacturer's recommendations.

Connecting sections of the work surface shall be reasonably flush within the manufacturer's tolerances for the material used and respective fabrication process. Work surface shall be installed to achieve a uniform alignment of the front edge of the tops.

Overhang of counter edges, in relation to furniture and cutouts for sinks, service fittings and electrical outlets shall be consistent and as indicated on approved shop drawings and installed accordingly.

Common methods of installing work surfaces and finishing joints involve adhesive “z” clips or other mechanical devices. Slab types, (stone, epoxy, phenolic etc.), are fastened to understructures with appropriate adhesives, (silicone RTV sealant, epoxy cement, etc.). Wood, wood products core or fiber-cement tops are fastened to understructures with screws. Joints in work surfaces are typically grouted butt joints, or mechanically fastened joints. It is recommended that potable water be available in or near the rooms where counter tops are designated to be installed.

8.7.1 Mechanically Fastened Joints

Joints in plastic laminate, wood and similar tops shall be drawn tight and held in alignment by appropriate clamping devices such as tight joint fasteners. Appropriate sealant shall be applied to the joint surface to provide moisture, chemical resistance, and adhesive fastening. Alignment tolerances shall be +/- 0.010-inch (0.25 mm) in height of adjacent surfaces and 1/32-inch (0.8 mm) or less joint width.

8.7.2 Grouted Butt Joints

Joints in butted slab type work surfaces, (epoxy, stone, stainless butted, phenolic etc.) shall be set to allow 1/8-inch +/- 1/16-inch (1.5 mm) joint width with adjacent surfaces aligned +/- 1/16-inch (1.5 mm) along length of joint. Joints shall be grouted with appropriate sealant, dressed neatly and smoothly. “Washout” of grout in joints shall not exceed 1/16-inch (1.5 mm).

8.7.3 Field Welded Stainless Steel Joints

Where stainless steel tops are specified to be field welded, the field joints shall be continuously welded, ground and polished to the same finish as the top. The resulting joint shall blend evenly with no buckling or discoloration.

8.8 Sink Bowls and Troughs

Appropriate sealant as specified or recommended by the SEF supplier shall be used at the joint between the work surface and sink bowls, typically silicone RTV sealant, or epoxy cement.
Under counter installations of epoxy, polyolefin or other sink bowls shall include supportive means other than the sealant as recommended by the SEF supplier.

When installing sinks at ADA locations consideration should be given to sink outlet (drain) location. Using a sink with a corner drain often facilitates ease of trap installation, as opposed to the center drain type, and keeps the plumbing out of the way of the user.

8.9 Installation of Laboratory Service Fittings

The installer responsible for the installation of laboratory service fittings shall follow good plumbing practice. Installers shall, in particular: Thoroughly clean and flush supply lines prior to installing fittings, as pipe shavings, scale and other debris can be carried through a pipe and into a faucet or valve when the plumbing system is activated. Such foreign matter can damage valve components and interfere with the proper operation of the fitting.

Secure the fitting to a counter top or wall using the locknut and lock washer provided by the manufacturer. Tighten the locknut sufficiently to secure the fitting to the counter or wall, but care shall be taken not to over-tighten.

Observe the manufacturer’s recommended test and working pressures for fittings. Testing or using a fitting at pressure for which it is not designed can result in leakage or failure.

Clean fittings using a soft cloth and soapy water. Use of abrasives, detergents or other cleaners can damage the finish on a fitting. Solvents shall not be used in or near a fitting, as solvents can dissolve lubricants used in the valve mechanism of a fitting.

Care must be used when installing the fixtures so as not to scratch the surface finish of faucets or valves. Refer to the manufacturer with regards to proper tools to remove serrated tips, aerators and aspirators with a corrosion resistant finish.

8.10 Traps and Dilution/Neutralization Tanks

Traps shall be carefully inspected prior to installation for all gaskets and o-rings, which may be inserted loose inside the trap to prevent these small parts from becoming lost in shipment. Connect traps to minimum 1-1/2 acid waste piping which conforms to ASTM 1412 standard.

Dilution & Neutralization tanks shall be placed on flat surfaces of sufficient strength to support the weight of a full tank. They shall never be suspended from the plumbing.

Neutralization tanks shall be placed in position, filled with water then the neutralization media added. The media shall be loaded into the tank in such a manner as to not damage the tank, the tank top, inlet and outlet connections, dip pipe, or the vent. The water added for this procedure is intended to slow down the impact of the limestone chips, but it is not necessary for the neutralization process. This neutralization material should fill the tank from its bottom to within one inch below the bottom of the outlet, and have a high, (90%+), calcium carbonate content.

Fittings marked with connections designed to be tightened by hand shall not be installed using tools or over tightened, over tightening can cause the fittings to leak.

8.11 Related Equipment

Related equipment shall be installed according to the respective manufacturer’s recommended installation procedure. Care shall be exercised to protect the surfaces of all equipment, (casework – SEFA 8, tops – SEFA 3 etc.), being installed. Reference the specific recommended practices for the item being installed for any suggested protection methods.

9.0 Site Clean up

It shall be the responsibility of the SEF supplier or installer to remove the packaging debris and other waste resulting from the installation. The area shall be, where possible, left in a “broom
clean” condition. This debris shall be placed in acceptable containers, either for recycling or general disposal. Recyclable products shall be in appropriate containers by material type and not be mixed with other debris. The container or dumpster will be provided by the owner/contractor at no cost to the SEF supplier. The SEF supplier or his installer shall not be expected to clean up the debris of other trades.

10.0 Inspection Cycle

10.1 Notification

Prior to requesting an inspection, it is recommended to perform a punch list to verify the installation is complete. It shall be the responsibility of the SEF supplier or his installer to notify the proper authorities when certain areas, by floor or room, are ready for inspection; and within five (5) working days of the SEF Supplier’s notification, the owners designated representative shall make inspection. Completed areas shall be secured and access strictly limited to essential personnel only until final acceptance.

10.2 Final Acceptance

It shall be the responsibility of the SEF supplier to remedy deficiencies, if any, and request a final acceptance of the laboratory furniture and equipment.

10.3 Warranties

Manufacturer’s warranties apply to the equipment as installed. A defect found after acceptance shall be remedied as part of the warranty provisions of the manufacturer, if applicable; and after repair or replacement, and required mechanical or electrical disconnections and reconnection will be the owner’s responsibility. If items of equipment are separately warranted by other than the SEF supplier, the warranty documentation shall be provided to the proper authorities for the owner’s protection and used in obtaining service, if required.

11.0 References


SEFA 3-2010 – Recommended Practices for Laboratory Work Surfaces.

SEFA 4-2010 – Glossary of Terms for Recommended Practices.

SEFA 7-2010 – Recommended Practices for Laboratory Fixtures.


SEFA 11-2010 – Recommended Practices for Liquid Chemical Storage

Scientific Equipment & Furniture Association
Recommended Practices

SEFA 3 - 2010
Laboratory Work Surfaces

SEFA World Headquarters
65 Hilton Avenue
Garden City, NY 11530
Tel: 516-294-5424
Fax: 516-294-2758
www.sefalabs.com
# Table of Contents

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Committee Members</td>
<td>118</td>
<td></td>
</tr>
<tr>
<td>Foreword</td>
<td>119</td>
<td></td>
</tr>
<tr>
<td><strong>SECTIONS</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.0 Scope and Purpose</td>
<td>120</td>
<td></td>
</tr>
<tr>
<td>2.0 Performance Criteria</td>
<td>120</td>
<td></td>
</tr>
<tr>
<td>2.1 Chemical/Stain Resistance</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.2 Abrasion and Scratch Resistance</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.3 Ease of Cleaning</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.4 Appearance</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.5 Heat/Cold Resistance and Thermal Shock</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.6 Flammability/Flame Spread</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.7 Impact Resistance</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.8 Load Bearing Capability</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.9 Bacterial Resistance</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.10 Water Absorption</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3.0 Design Guidelines for Fabricated Work Surfaces and Sinks</td>
<td>122</td>
<td></td>
</tr>
<tr>
<td>3.1 Fabricated Work Surfaces Guidelines for Tolerance (prior to installation)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3.2 Sinks, Cupsinks and Special Use Sinks for Laboratories</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4.0 Storage, Handling and Installation Guidelines</td>
<td>123</td>
<td></td>
</tr>
<tr>
<td>5.0 General Description of Commonly Used Laboratory Work Surfaces and Sink Materials</td>
<td>123</td>
<td></td>
</tr>
<tr>
<td>5.1 Edge Grain Hardwood</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5.2 Epoxy Resin</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5.3 Fiber-Cement</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5.4 High Pressure Plastic</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5.5 Impregnated Natural Sand Stone</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5.6 Polyolefin Sinks</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5.7 Solid Phenolic Composite</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5.8 Solid Surface</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5.9 Stainless Steel</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5.10 Wood Fiber and Thermo Set Composite</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6.0 Protection, Care and Maintenance of Work Surfaces and Sinks</td>
<td>124</td>
<td></td>
</tr>
<tr>
<td>6.1 Protect surfaces and sinks</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6.2 Care and Maintenance of Laboratory Work Surfaces and Sinks</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6.3 Reagents</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6.4 Removal of stains</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6.5 Extreme Temperatures</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7.0 References</td>
<td>124</td>
<td></td>
</tr>
</tbody>
</table>
SEFA 3—Laboratory Work Surfaces Committee Members

Co-Chairs

Valerie Ross - Trespa, N.A.
Frank Conner, TFI Inline Design

Dalton Corporation
Durcon, Incorporated
Eagle MHC
Kewaunee Scientific Corp.
Scientific Plastics
Trespa, BV
Foreword

SEFA Profile

The Scientific Equipment and Furniture Association (SEFA) is an international trade association comprised of manufacturers of laboratory furniture, casework, fume hoods and members of the design and installation professions. The Association was founded to promote this rapidly expanding industry and improve the quality, safety and timely completion of laboratory facilities in accordance with customer requirements.

SEFA Recommended Practices

SEFA and its committees are active in the development and promotion of Recommended Practices having domestic and international applications. Recommended Practices are developed by the association taking into account the work of other standard-writing organizations. Liaison is also maintained with government agencies in the development of their specifications.

SEFA's Recommended Practices are developed in and for the public interest. These practices are designed to promote a better understanding between designers, architects, manufacturers, purchasers, and end-users and to assist the purchaser in selecting and specifying the proper product to meet the user's particular needs. SEFA's Recommended Practices are periodically updated. The Recommended Practices are numbered to include an annual suffix which reflects the year that they were updated. SEFA encourages architects to specify these Recommended Practices as follows: “SEFA 3-2010”.

SEFA Glossary of Terms

SEFA has developed a Glossary of Terms (SEFA 4-2010) for the purpose of promoting a greater understanding between designers, architects, manufacturers, purchasers and end users. The terms defined by SEFA are frequently used in contracts and other documents, which attempt to define the products to be furnished or the work involved. The Association has approved this Glossary in an effort to provide uniformity among those who use these terms. Where a specific Recommended Practice contains definitions which differ from those in the Glossary of Terms, then the definitions in the specific Recommended Practice should be used.

SEFA encourages all interested parties to submit additional terms or to suggest any changes to those terms already defined by the Association. The definitions should be used to help resolve any disputes that may arise or to incorporate the applicable terms in any contract or related documents.

SEFA Disclaimer

SEFA uses its best effort to promulgate Recommended Practices for the benefit of the public in light of available information and accepted industry practices. SEFA does not guarantee, certify, or assure the safety or performance of any products, components, or systems tested, installed, or operated in accordance with SEFA Recommended Practices or that any tests conducted under its Recommended Practices will be non-hazardous or free from risk. SEFA encourages the use of third party independent testing where appropriate.

Note: Testing as described in this document must be performed and documented by a SEFA-approved third party testing facility. See Page 34 of the SEFA Desk Reference 5th Edition Version 2.0, or visit us at SEFALABS.COM for the most current list of SEFA-approved test labs.
1.0 Scope and Purpose

SEFA guidelines are intended to provide manufacturers, specifiers and users with specific information helpful in their evaluation of the safety, durability and structural integrity of laboratory casework and complementary items. While SEFA attempts to provide professionally appropriate information to manufacturers, specifiers and users, it is the sole responsibility of manufacturers, specifiers and users to determine the appropriateness of the information and interpretations of it for their use in determining which products and guidelines are appropriate for their intended uses. The scope of SEFA 3 is limited to work surfaces and sinks. Although SEFA attempts to be inclusive of all generic products normally used in laboratories and welcomes information about such products for inclusion in SEFA 3, SEFA does not represent that every potential product is included. The products included in this version of SEFA 3 are the following: for work surfaces—Edge Grain Hardwood, Epoxy Resin, Fiber Cement, High Pressure Laminate, Impregnated Natural Stone, Solid Phenolic Composite, Solid Surface, Stainless Steel, Welded Fiber and for sinks—Epoxy Resin, Polyolefin, Solid Surface and Stainless Steel.

2.0 Performance Criteria Often Appropriate in the Selection of Work Surfaces and Sinks (included are specific test procedures which may be considered to assess these characteristics)

Depending on the user’s needs, the following product performance criteria may be appropriate in the user’s selection process along with supplier information and reputation, cost and other aspects important to users. SEFA’s intent is to stimulate users to consider and define their needs and to encourage suppliers to provide information on commonly used tests in the laboratory industry to evaluate performance characteristics the user deems appropriate for its specific use. Once user needs are defined, appropriate information may be requested from suppliers. Other criteria may also be appropriate to a given laboratory user and such information should be requested of suppliers when needed. Common tests are stated for screening work surface and sink products dependent upon the users needs (criteria which is important to the user in their particular lab environment). In addition to requesting test results from suppliers appropriate to the user’s needs, users should understand the validity and reliability of the test method and data and whether such data is merely “representative” or “certified” and what, if any warranty is given by the supplier.

2.1 Chemical/Stain Resistance

Users should consider the chemical and staining agents that might be used on or near the laboratory work surface or sink. Common guidelines can be found by referring to: The work surface manufacturer printed data for chemical and stain resistance, NEMA LD3-2000 for wood product chemical resistance, ASTM D3023 and ASTM C1378 for stain resistance or the most current versions. Because chemical and stain resistance is affected by concentration, time, temperature, humidity, housekeeping and other factors, it is recommended that users test samples in their actual environment with the substances they use.

2.1.1 Chemical/Stain Resistance Test

The purpose of the chemical stain resistance test is to evaluate the resistance a finish has to chemical spills.

Test Method A – For volatile chemicals – A cotton ball, saturated with the test chemical, was placed in a one ounce bottle (10mm x 7mm test tube or similar container). The container was inverted on the test material surface for a period of 24 hours. Temperature of test: 23° +/- 2°C (73° +/- 4°F). This method was used for the organic solvents.

Test Method B – For non-volatile chemicals – Five drops (1/4cc) of the test chemical were placed on the test material surface. The chemical was covered with a watch glass (25mm) for a period of 24 hours. Temperature of test: 23° +/- 2°C (73° +/- 4°F). This method was used for all chemicals listed below other than solvents.
2.1.2 Acceptance Level

After 24-hours exposure, exposed areas were washed with water, then a detergent solution and finally with isopropyl alcohol. Materials were then rinsed with distilled water and dried with a cloth. Samples are numerically rated as follows:

0 – No Effect – No detectable change in the material surface.

1 – Excellent – Slight detectable change in color or gloss but no change in function or life of the surface.

2 – Good – A clearly discernible change in color or gloss but no significant impairment of surface life or function.

3 – Fair – Objectionable change in appearance due to discoloration or etch, possibly resulting in deterioration of function over an extended period of time.

Results will vary from manufacturer to manufacturer due to differences in composition and finish formulations and applications processes. Laboratory Grade work surface finishes shall result in no more than 4 Level 3 conditions. Individual test results for the specified 49 reagents will be verified with an established third party independent SEFA 3 test submittal form. Suitability for a given application is dependent upon the chemicals used in a given laboratory.

2.2 Abrasion and Scratch Resistance

Users should consider the likelihood of uses causing abrasion, wear or scratches to the work surface or sink. Common guidelines are found in ASTM C501, NEMA LD3-3.13-2000 and NEMA LD3.7-2000 or the most current versions.

2.3 Ease of Cleaning

While a regular schedule of maintenance and housekeeping is always recommended including cleaning up spills immediately, some laboratories, e.g., those working with pathogens and radioactive isotopes, may be required to select non-porous materials and smooth surfaces for their lab work surfaces. Common guidelines

<table>
<thead>
<tr>
<th>Test No.</th>
<th>Chemical Reagent</th>
<th>Test Method</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Acetate, Amyl</td>
<td>A</td>
</tr>
<tr>
<td>2.</td>
<td>Acetate, Ethyl</td>
<td>A</td>
</tr>
<tr>
<td>3.</td>
<td>Acetic Acid, 98%</td>
<td>B</td>
</tr>
<tr>
<td>4.</td>
<td>Acetone</td>
<td>A</td>
</tr>
<tr>
<td>5.</td>
<td>Acid Dichromate, 5%</td>
<td>B</td>
</tr>
<tr>
<td>6.</td>
<td>Alcohol, Butyl</td>
<td>A</td>
</tr>
<tr>
<td>7.</td>
<td>Alcohol, Ethyl</td>
<td>A</td>
</tr>
<tr>
<td>8.</td>
<td>Alcohol, Methyl</td>
<td>A</td>
</tr>
<tr>
<td>9.</td>
<td>Ammonium Hydroxide, 28%</td>
<td>B</td>
</tr>
<tr>
<td>10.</td>
<td>Benzene</td>
<td>A</td>
</tr>
<tr>
<td>11.</td>
<td>Carbon Tetrachloride</td>
<td>A</td>
</tr>
<tr>
<td>12.</td>
<td>Chloroform</td>
<td>A</td>
</tr>
<tr>
<td>13.</td>
<td>Chromic Acid, 60%</td>
<td>B</td>
</tr>
<tr>
<td>14.</td>
<td>Cresol</td>
<td>A</td>
</tr>
<tr>
<td>15.</td>
<td>Dichloracetic Acid</td>
<td>A</td>
</tr>
<tr>
<td>16.</td>
<td>Dimethylformamide</td>
<td>A</td>
</tr>
<tr>
<td>17.</td>
<td>Dioxane</td>
<td>A</td>
</tr>
<tr>
<td>18.</td>
<td>Ethyl Ether</td>
<td>A</td>
</tr>
<tr>
<td>19.</td>
<td>Formaldehyde, 37%</td>
<td>A</td>
</tr>
<tr>
<td>20.</td>
<td>Formic Acid, 90%</td>
<td>B</td>
</tr>
<tr>
<td>21.</td>
<td>Furfural</td>
<td>A</td>
</tr>
<tr>
<td>22.</td>
<td>Gasoline</td>
<td>A</td>
</tr>
<tr>
<td>23.</td>
<td>Hydrofluoric Acid, 37%</td>
<td>B</td>
</tr>
<tr>
<td>24.</td>
<td>Hydrofluoric Acid, 48%</td>
<td>B</td>
</tr>
<tr>
<td>25.</td>
<td>Hydrogen Peroxide, 30%</td>
<td>B</td>
</tr>
<tr>
<td>26.</td>
<td>Iodine, Tincture</td>
<td>B</td>
</tr>
<tr>
<td>27.</td>
<td>Methyl Ethyl Ketone</td>
<td>A</td>
</tr>
<tr>
<td>28.</td>
<td>Methylen Chloride</td>
<td>A</td>
</tr>
<tr>
<td>29.</td>
<td>Monochlorobenzene</td>
<td>A</td>
</tr>
<tr>
<td>30.</td>
<td>Naphthalene</td>
<td>A</td>
</tr>
<tr>
<td>31.</td>
<td>Nitric Acid, 20%</td>
<td>B</td>
</tr>
<tr>
<td>32.</td>
<td>Nitric Acid, 30%</td>
<td>B</td>
</tr>
<tr>
<td>33.</td>
<td>Nitric Acid, 70%</td>
<td>B</td>
</tr>
<tr>
<td>34.</td>
<td>Phenol, 90%</td>
<td>A</td>
</tr>
<tr>
<td>35.</td>
<td>Phosphoric Acid, 85%</td>
<td>B</td>
</tr>
<tr>
<td>36.</td>
<td>Silver Nitrate, Saturated</td>
<td>B</td>
</tr>
<tr>
<td>37.</td>
<td>Sodium Hydroxide, 10%</td>
<td>B</td>
</tr>
<tr>
<td>38.</td>
<td>Sodium Hydroxide, 20%</td>
<td>B</td>
</tr>
<tr>
<td>39.</td>
<td>Sodium Hydroxide, 40%</td>
<td>B</td>
</tr>
<tr>
<td>40.</td>
<td>Sodium Hydroxide Flake</td>
<td>B</td>
</tr>
<tr>
<td>41.</td>
<td>Sodium Sulfide Saturated</td>
<td>B</td>
</tr>
<tr>
<td>42.</td>
<td>Sulfuric Acid, 33%</td>
<td>B</td>
</tr>
<tr>
<td>43.</td>
<td>Sulfuric Acid, 77%</td>
<td>B</td>
</tr>
<tr>
<td>44.</td>
<td>Sulfuric Acid 96%</td>
<td>B</td>
</tr>
<tr>
<td>45.</td>
<td>Sulfuric Acid, 77% &amp; Nitric Acid, 70% equal parts</td>
<td>B</td>
</tr>
<tr>
<td>46.</td>
<td>Toluene</td>
<td>A</td>
</tr>
<tr>
<td>47.</td>
<td>Trichloroethylene</td>
<td>A</td>
</tr>
<tr>
<td>48.</td>
<td>Xylene</td>
<td>A</td>
</tr>
<tr>
<td>49.</td>
<td>Zinc Chloride, Saturated</td>
<td>B</td>
</tr>
</tbody>
</table>
include ASTM D4488, ASTM G122 and NEMA LD3-3.4-2000.

2.4 Appearance

Users should consider the importance of initial and long-term appearance on work surfaces and sinks. Housekeeping practices are also critical to maintaining appearance. Users should also consider whether the color of the work surface or sink is important and when it is, consult the work surface manufacturer for color availability. Sometimes performance characteristics are influenced by color so users should seek supplier's advice when selecting colors. Common guideline is ASTM F1037.

2.5 Heat/Cold Resistance and Thermal Shock

Users should ascertain the range of temperatures to which the work surface and sink may be exposed as well as the duration of the exposure at temperatures within the range. Also, if rapid changes in temperature may be encountered, e.g., dry ice in the sink, thermal shock should be considered. In addition, heat may cause blisters, cracks and breakdowns in the surface. Consult the work surface manufacturer for Hot Crucible and Bunsen Burner information. Commonly used guidelines for Heat Distortion are ASTM D648, ASTM C484 and Thermal Coefficient of Expansion ASTM D696.

2.6 Flammability/Flame Spread

Users should ascertain whether sources of flame may be encountered or if there are code requirements for the intended use. Common guidelines are ASTM E84, D3713, D5048, D3801, D635, UL 723 and NFPA 225.

2.7 Impact Resistance

Users should consider the likelihood and nature of objects impacting the work surface and sinks. Common guidelines are ASTM D256, D4508, D5420, D628, E1321 and Rockwell M hardness ASTM D785.

2.8 Load Bearing Capability

Users should consider the maximum loads that the work surface and sink will have to bear. The extent of support underneath the work surface and sink should also be included in the assessment. Common guidelines are: Compressive Strength ASTM D695 (the measure of resistance to a crushing force), Flexural Strength ASTM D790 (resistance to bending stresses), Tensile Strength ASTM D638 (amount of pull required to break a sample of material).

2.9 Bacteria Resistance

Users should consider the importance in their use of the work surface's and sink's ability to resist, support or promote bacterial growth and to be decontaminated or disinfected. Common guidelines are ASTM E1428, ASTM G-22 ANSI Z124.6, and NSF51.

2.10 Water Absorption

Users should consider the effects of moisture on work surfaces and sinks. A common guideline is ASTM D570.

3.0 Fabricated Work Surfaces and Sinks

3.1 Fabricated Work Surfaces Tolerance (prior to installation)

Guidelines prior to installation shall be in accordance with fabricator's standards.

Color, Texture, Finish, Edge Detail and Drip Groove: See individual manufacturer's guidelines for a detailed description. It is further suggested that before specifying any material, samples be obtained and approved.

3.2 Sinks, Cupsinks and Special Use Sinks for Laboratories

3.2.1 It is recommended that all sinks for laboratory use shall be provided with a drain
outlet measuring no less than 1-1/2” diameter. Drain fittings shall conform to ANSI 124.6 sec 4.1.1 connection test.

3.2.2 Laboratory sinks shall be fabricated to have an internal basin fall of no less than one degree to allow for proper draining.

3.2.3 The laboratory sinks shall have a load bearing capacity of 1-1/2 times the maximum volume of water weight that the sink can hold. A gallon of water is 231 cubic inches and is 8.3 pounds.

3.2.4 Sinks shall be provided with a plug and strainer, overflow that is either integral with inlet located two inches below the top of the sink and back flow preventer, or with a standpipe overflow terminating two inches below the top of the sink (Exclude cupsinks, people ask for stoppers and a cupsink is a disposal sink)

3.2.5 Sink support and mounting shall be per manufacturer’s recommendations.

3.2.6 ADA requirements: Refer to ADA section of recommended practice.

4.0 Recommended Storage, Handling and Installation Guidelines

Refer to Current SEFA 2 Installation Recommended Practices.

5.0 General Description of Commonly Used Laboratory Work Surface and Sink Materials

5.1 Edge Grain Hardwood

Multiple strips of solid edge grain hardwood glued together which can be finished in penetrating oil or clear synthetic finish.

5.2 Epoxy Resin

Epoxy resin tops and sinks are produced from a composite of epoxy resin, silica, inert fillers and organic hardeners. Material is cast and cured in ovens at elevated temperatures. Material is homogeneous throughout and non-absorbent.

5.3 Fiber-Cement

Fiber-cement tops are integrally pigmented fiber cement sheets formed by utilizing either the filter press or Hatcheck process. Material is steam cured in an autoclave oven in order to accelerate the curing cycle of cement.

5.4 High Pressure Plastic Laminate

High pressure plastic laminate tops are made from melamine-impregnated surface papers pressed over phenolic-impregnated kraft paper layers. The back is sanded to facilitate bonding to the top of suitable substrate.

5.5 Impregnated Natural Sand Stone

Impregnated natural sand stone tops are produced from stone, free of veins or seams and impregnated with a resin with additional surface coatings baked at a high temperature to polymerize the resins and harden the stone.

5.6 Polyolefin Sinks

Sinks formed from a class or group name for thermoplastic polymers, derived from simple olefins, most predominant are polyethylene and polypropylene for laboratory use.

5.7 Solid Phenolic Composite

Solid phenolic composite tops are a compression molded composite of a homogeneous core of organic fiber reinforced phenolic and may contain one or more integrally cured surfaces that are non-porous.

5.8 Solid Surface

Solid surface tops and sinks are produced from a composite of natural minerals, acrylic and/or polyester resin, or epoxy resin, free from internal strengthening fibers, and pigment. The resulting product is homogenous throughout, renewable, and non-porous. Where appropriate, solid surface
may feature inconspicuous seams of similar composition.

5.9 Stainless Steel

Stainless steel tops and sinks are usually fabricated from 14 to 18-gauge type 304 or 316 series stainless steel. Surfaces are integrally formed with all seams fully welded with stainless steel fillers, ground smooth, and blended to a #4 mill finish (solder or compounded fillers not acceptable).

5.10 Wood Fiber & Thermo Set Composite

Wood fiber and thermo set composite tops are made of processed wood fiber substrate surrounded by a layer of reinforced thermo set resin and an acid resistant outer coating.

6.0 Protection, Care and Maintenance of Work Surfaces and Sinks

6.1 Protect surfaces and sinks prior to and during installation.

Never allow tradesman to walk on them or use them as a workbench or scaffolding, etc. Supplier is not responsible for damage to surfaces or sinks from tradesmen after installation and before acceptance.

6.2 Care and Maintenance of Laboratory Work Surfaces and Sinks

A regular schedule of cleaning and maintenance is the most effective means to prolong the surface life and attractiveness of all laboratory work surfaces and sinks for many years. Consult the supplier for suggested cleaning methods.

6.3 Reagents

Do not allow reagents to remain in contact with the working surface or sink longer than necessary. Clean up spills immediately.

6.4 Removal of stains

End users should consult the supplier for recommendations.

6.5 Extreme Temperatures

Avoid exposing work surface or sink to extreme temperatures or extreme changes in temperature. See manufacturer’s recommendations for acceptable hot and cold temperature.

7.0 References

ANSI- American National Standards Institute
1819 L Street, NW
Washington, DC 20036
www.ansi.org

ASTM-American Society for Testing & Materials
100 Barr Harbor Drive
West Conshohocken, PA 19428-2959
www.astm.org

NEMA- National Electrical Manufacturers Assoc.
1300 North 17th Street, Suite 1752
Rosslyn, VA 22209
www.nema.org

NFPA- National Fire Protection Association
1 Batterymarch Park
Quincy, MA 02169-7471
www.nfpa.org

U.L.- Underwriters Laboratories
333 Pfingsten Road
Northbrook, IL 60062-2096
www.ul.com

NSF- NSF
769 N. Dixboro Road
Ann Arbor, MI 48105-9723
www.nsf.org
Foreword

SEFA Profile

The Scientific Equipment and Furniture Association (SEFA) is an international trade association comprised of manufacturers of laboratory furniture, casework, fume hoods and members of the design and installation professions. The Association was founded to promote this rapidly expanding industry and improve the quality, safety and timely completion of laboratory facilities in accordance with customer requirements.

SEFA Recommended Practices

SEFA and its committees are active in the development and promotion of Recommended Practices having domestic and international applications. Recommended Practices are developed by the association taking into account the work of other standard-writing organizations. Liaison is also maintained with government agencies in the development of their specifications.

SEFA's Recommended Practices are developed in and for the public interest. These practices are designed to promote a better understanding between designers, architects, manufacturers, purchasers, and end-users and to assist the purchaser in selecting and specifying the proper product to meet the user's particular needs. SEFA's Recommended Practices are periodically updated. The Recommended Practices are numbered to include an annual suffix which reflects the year that they were updated.

SEFA Glossary of Terms

SEFA has developed this Glossary of Terms for the purpose of promoting a greater understanding between designers, architects, manufacturers, purchasers and end users. The terms defined by SEFA are frequently used in contracts and other documents, which attempt to define the products to be furnished or the work involved. The Association has approved this Glossary in an effort to provide uniformity among those who use these terms. Where a specific Recommended Practice contains definitions which differ from those in the Glossary of Terms, then the definitions in the specific Recommended Practice should be used.

SEFA encourages all interested parties to submit additional terms or to suggest any changes to those terms already defined by the Association. The definitions should be used to help resolve any disputes that may arise or to incorporate the applicable terms in any contract or related documents.

SEFA Disclaimer

SEFA uses its best effort to promulgate Recommended Practices for the benefit of the public in light of available information and accepted industry practices. SEFA does not guarantee, certify, or assure the safety or performance of any products, components, or systems tested, installed, or operated in accordance with SEFA Recommended Practices or that any tests conducted under its Recommended Practices will be non-hazardous or free from risk. SEFA encourages the use of third party independent testing where appropriate.
**Abrasion Resistance:** A measure of the resistance of the surface to wearing from articles slid across it. Can be determined by loss in weight or thickness caused by an abrasive agent moved across the surface following a fixed schedule.

**Acceptance Levels:** The acceptance level for each performance criteria is based on the cumulative experience of actual field testing and laboratory results of SEFA members. Acceptance levels describe the expected outcome of each test procedure.

**Access Opening:** The part of the fume hood through which work is performed; sash or face opening.

**Accessory:** A component which can, at the discretion of the user be readily added, removed, or replaced and which when removed, will not prevent the fitting from fulfilling its primary function.

**Aerator:** Any of a number of types of devices designed to deliver a mixture of air and water, at a specific G.P.M. rate.

**Air Foil:** Curved or angular member(s) at the fume hood entrance. A horizontal member across the lower part of the fume hood sash opening. Shaped to provide a smooth air flow into the fume chamber across the work surface.

**Air Gap:** The unobstructed vertical distance through the free atmosphere between the lowest opening from any pipe or faucet supplying water to a tank, plumbing fixture or other device and the flood level rim of the receptacle.

**Air Volume:** Quantity of air normally expressed in cubic feet per minute (cfm)

**Angel Panel Mount:** A type of mounting unit at a 30 degree or 45 degree angle to the table top.

**Angle Stops:** See angel valve

**Angle Valve:** A 90 degree valve, its inlet and outlet ports at 90 degrees with the operating stem at 180 degrees to the inlet port.


**ANSI/BIFMA:** ANSI is the American National Standards Institute. Approval of an American National Standard requires verification by ANSI that the requirements for due process, consensus, and other criteria for approval have been met by the standards developer. BIFMA is the Business and Institutional Furniture Manufacturer’s Association, an association of manufacturers of desk products and the like.

**Anti-Siphon Vacuum Breaker:** A devise or means to prevent back siphonage of water. (See Vacuum Breaker.)

**Apparatus:** A machine or group of machines and accessories.

**Arithmetic Mean:** A number obtained by dividing the sum of a set of quantities by the number of quantities in a set; average.

**Aspirator:** A device supplied with fluid under positive pressure which passes through an integral orifice or “construction” causing a partial vacuum,

**ASTM:** American Society for Testing and Materials.

**Auxiliary Air:** Supply or supplemental air delivered to a laboratory fume hood to reduce room air consumption.

**Baffle:** Panel located across the rear wall of the fume hood chamber interior and directs the air flow through the fume chamber.

**Ball Type Valve:** Valve used for the purpose of controlling gases or water. The seal is achieved by the use of a spherical “ball” which is positioned between two (2) gasket type de devices which are within a body housing and prevent bypass of fluids or gasses. Similar to Stops.

**Base Cabinets:** A base cabinet is a storage devise consisting of two ends, a back, and a face. The face may be open, to access the storage area, or
may be outfitted with one or more drawers and/or door(s). The base cabinet may or may not include a top. A base cabinet is always mounted on the floor and normally supports a surface. The top surface is normally no more than 42” (1,066.8mm) off the floor surface.

**Blower:** Air moving device, sometimes called a fan, consisting of a motor, impeller and housing.

**Broom Clean:** A condition in an interior area in which surface debris has been removed by dry methods.

**BS 7258:** A fume hood containment test developed by the British Standard Association, used in most commonwealth countries.

**Built-In Fitting:** A fitting, the body of which is concealed behind the finished wall.

**Bypass:** Compensating opening in a fume hood that functions to limit the maximum face velocity as the sash is raised or lowered.

**Cabinet Depth (Deep):** Given a front, bottom, two sides, and a top, the cabinet depth is a measure of the side of the cabinet, in its normal upright position, from the back to the front.

**Cabinet Height:** Given a front, bottom, two sides, and a top, the cabinet height of the side of the cabinet in its normal upright position, from the bottom to the top, excluding any additional surface.

**Cabinet Width:** Given a front, bottom, two sides, and a top, the cabinet width is a measure of the front of the cabinet in its normal upright position from one side to the other.

**California Type Hood:** A rectangular enclosure used to house distillation apparatus that can provide visibility from all sides with horizontal sliding access doors along the length of the assembly.

**Canopy Hood:** Ventilating enclosure suspended above work area to exhaust heat, vapor or odors. This device is not a laboratory fume hood.

**Capture Velocity:** Speed of air flowing past the face opening through a fume chamber at a speed necessary to capture generated fume vapors and/or particulates and directed to the exhaust outlet. Measured in feet per minute (fpm) or meter per second (mps).

**Casework:** Base and wall cabinets, display fixtures, and storage shelves. The generic term for both “boxes” and special desks, reception counters, nurses stations and the like. Generally includes the tops and work surfaces.

**Celcon®:** An acetyl copolymer used for distilled water. Celcon® is a high strength, crystalline, thermoplastic resin that contains properties to resist chemicals most commonly used in laboratories, and producing low leachate levels.

**Centerset Fitting:** An exposed combination supply fitting for assembly through the top or deck of a fixture.

**Chase (Plumbing Area):** Space located behind the back of the base cabinet used to house plumbing or electric lines.

**Char Resistance:** The ability of a top to withstand surface deterioration due to elevated temperature.

**Check Valve:** A valve that permits flow in one direction, but that closes automatically to retard or obstruct the flow of fluid in a reverse direction.

**Cold Rolled Steel:** Sometimes referred to as Cold Drawn. Cold Drawn is the process of cold forming steel parts wherein plastic flow occurs over a curved axis.

**Cold Water:** For test purposes, water at a temperature of 40 degrees F. to 70 degrees F. (5 degrees C. to 21 degrees C.)

**Composition Core:** A core material using particleboard.

**Combination Faucet:** A supply fitting with more than one supply inlet delivering a mixture of hot and cold water through a single spout.
Combination Hood: A fume hood assembly containing a bench hood section and a walk-in section.

Combination Sash: A fume hood sash with a framed member that moves, vertically housing two or more horizontal sliding transparent viewing panels.

Combination Unit: A base unit of the type that has both doors(s) and drawer(s)

Combination Fitting: A fitting with body mounted beneath or behind the fixture or table top.

Concealed Fittings: A fitting with body mounted beneath or behind the fixture or table top.

Counter Mounted Cabinet: A counter mounted cabinet is a wall cabinet [usually with a height of approximately 48” (1,219.2mm)] and is typically mounted on the work surface or shelf, as in a reagent shelf

Countertop: Work surface resting on a base cabinet normally three feet (91.4cm) (.914m) high.

Critical Level: The level at which polluted water, entering through an outlet from the supply fitting, will flow back to the supply lines by gravity and/or any negative pressure in the supply line when the water control valve is wide or fully open.

Cross Drafts: Air draft that flows parallel to or across the face opening of the fume hood.

Cupboard (Door Unit): The portion of the cabinet with no drawer(s) and may be enclosed by door(s)

Customer: Can be any one or combination of these listed: Architect, Buyers, Contractors, Engineers, End Users, Specifying Engineers, Purchasers, Construction Mangers or Owners.

Damper: Device installed in a duct to control air flow volume.

Demonstration Hood: A vented enclosure used for student demonstrations that has visibility on at least two sides, used primarily in schools. This device is not a laboratory fume hood.

Density: The weight of one cubic inch of finished material (or gr per cc).

Distillation Hoods: A laboratory fume hood that provides a work surface approximately 18 inches (45.7 cm) (0.457 m) above the room floor, to accommodate tall apparatus.

Double Ledge Faucet: Single shank water faucet which supplies hot and cold water to a sink or other location where required.

Double Panel Flange: Similar to single panel flange but with two outlets.

Drain Line: The pipe or tubing used to connect the sink tail piece or trap to the building waste line.

Drawer: A sliding storage box or receptacle opened by pulling out and closed by pushing in.

Dual Entry Hood: A bench type fume hood that has two sash openings, usually on opposite sides.

Duct: Round square or rectangular tube used to enclose moving air.

Duct Velocity: Speed or air moving in a duct, usually expressed in feet per minute (fpm) or meters per seconds (mps)

Effective Waterway Opening: The minimum cross-section area at the point of water supply discharge measure or expressed in terms of (1) diameter of a circle, or (2) if the opening is not circular, the diameter of a circle of equivalent cross-section area.

Elbow: A fitting that forms an angular bend.

Electrical Service Fixture: Outlet or other electrical device directly attached to the laboratory furniture and equipment.

Emergency Spray Unit: A flexible hose type device used for flushing the face or clothing of person who accidentally comes into contact with acid or similar dangerous substances.
**Exhaust Collar:** Connection between duct and fume hood through which all exhaust air passes.

**Exposed Fitting:** A fitting where the body is mounted on or above the finished surface.

**Face:** Front access or sash opening of laboratory fume hood. Face opening measured in width and height. See sash or access opening.

**Face Velocity:** Average speed of air flowing perpendicular to the face opening and into the fume chamber of the fume hood and expressed in feet per minute (fpm), measured at the plane of the face or sash opening.

**Fan:** Air moving device, usually called a blower, consisting of a motor, impeller and housing.

**Faucet:** A valve device designed to control and/or guide the flow of water.

**Filler Panel:** A panel used to close an open area between a unit and a wall or between two units.

**Filter:** Device to remove particles from air.

**Filter Pump:** See Aspirator

**Fitting:** See Service Fitting

**Fixture:** A sink or receptacle that receives water or water-borne waste and discharges into a drainage system. Note: The term fixture has long been used in the laboratory field to describe a service fitting. (See: Service Fitting.)

**Flame Resistance:** The ability of the top to withstand flame.

**Flange-Faucet:** A faucet flared out as in a flange shape so as to cover over edges of mounting holes or holes or to provide a support.

**Flood Level Rim:** The flood level rim is the top edge of a receptacle over which water would overflow.

**Foot Valve:** A water control device operated by one's foot. (Also see: Pedal Valve.)

**Free Standing:** Requiring no support or fastening to other structures.

**Front Load Valve:** Valves usually installed in the walls of fume hoods for controlling gases or water, with the handle and cartridge having access from the face of the hood, without the need to remove the entire valve from the hood.

**Fuel Gas:** A gas used to supply heat.

**Fume Chamber:** The interior of the fume hood measured in width, depth, and height constructed of material suitable for intended use.

**Fume Removal System:** A fume hood exhaust engineered to effectively move air and fumes consistently through fume hood, duct and exhaust blower.

**Note:** Room air, make-up air, auxiliary air (if used) and pollution-abating devices (if used) are integral parts of a properly functioning system and should be considered when designing a fume removal system.

**Furnish:** Supply to other contractors; not installed by Laboratory Furniture Equipment Manufacturer.

**Gas Cock:** A ground key or ball type shutoff valve used to control the flow of gas services, low pressure air or vacuum.

**Glove Box:** Total enclosure used to confine and contain hazardous materials with operator access by means of gloved portals or other limited openings; this device is not a laboratory fume hood.

**Gooseneck:** A piece of pipe or tubing the shape of which conforms to the letter “U”, is part of a faucet or fixture, and whose function is to direct the flow of water and other laboratory services to a certain point. It may be of the rigid or swivel type.

**Ha Test:** This is an abrasion resistance test in which an abrasive wheel with uniform predetermined weight is applied against the surface for a predetermined time to establish the depth of penetration.

**Hardness:** A measure of resistance of the surface and body of the material to denting or scratching, determined by the diameter (or depth) of a spherical (or other) point pressed against the
surface with known load or the width of a groove produced by a tool of known contour.

**Hardware:** Manufactured articles used in producing cabinets. Such articles include items such as screws, pulls, hinges, and drawer slides.

**Heat Resistance:** The temperature that a top can withstand without deteriorating.

**High Density Shielding:** A barrier made of lead.

**High Pressure Laminate:** Laminated thermosetting decorative sheets for lamination to a selected core for panel, shelf and top constructions.

**Hose Cock:** A ground key, needle type or ball type shutoff valve used to control the flow of air, vacuum or gas services.

**Imbalance:** Condition in which ratio of quantities of supply air is greater or lesser than the exhaust air.

**Impact Resistance:** A measure of toughness that is determined by the energy absorbed in causing the fracture under an impact blow.

**Index Button:** An indicator of the services being supplied by the fitting to which it is attached. Normally color coded.

**Integral Vacuum Breakers:** A vacuum breaker which is formed as a unit with the faucet gooseneck.

**Job Site:** Physical location or building site where laboratory furniture is to be installed.

**Joinery:** The junction of two pieces intended to be permanently connected.

**Knee Space Panel:** A panel used to close the area under an apron, to enclose the plumbing space, or to shield the knee space area.

**Laboratory Furniture:** Furniture designed and manufactured for installation and use in a laboratory.

**Laboratory Furniture and Equipment:** The casework, fume hoods, work surfaces, sinks, fixtures, shelves, and associated hardware as detailed.

**Laminate:** A product made by bonding together two or more layers (laminations) or material or materials.

**Laminar Flow Cabinets:** Name applied to clean bench or biological enclosures. This device is not a laboratory fume hood.

**Latch:** A piece of hardware designed to hold a door closed.

**Leveling Screws (Levelers):** Threaded components designed to allow adjustment of the cabinet vertically as needed for leveling.

**Liner:** Interior lining used for side, back and top enclosure panels, exhaust plenum and baffle system of a laboratory fume hood.

**Make-Up Air:** Air needed to replace the air taken from the room by laboratory fume hood(s) and other air exhausting devices.

**Manifold:** A fitting or pipe with many outlets or connections relatively close together.

**Manometer:** Device used to measure air pressure differential, usually calibrated in inches of water.

**Medium Density Fiberhood (MDF):** Wood particles reduced to fibers in a moderate pressure steam vessel combined with a resin and bonded together under heat and pressure.

**Mixing Valve:** A valve or faucet designed to mix liquids by means of automatic or manual regulation.

**Monel:** An alloy of approximately 67% nickel, 28% copper and 5% other elements that is made by direct reduction from ore in which the constituent metals occur in these proportions.

**Needle Hose Cock:** A control device in which the opening, consisting of a small hole, is opened or closed by a needle or cone that is thrust into or is
withdrawn from the hole. Normally used for fine control and/or high pressure gases.

**Negative Air Pressure:** Air pressure lower than ambient.

**Nipple:** A short piece of threaded pipe.

**Nominal Dimensions:** Not all cabinet manufactures produce product to the identical dimensions. All dimensions given in this document are accurate to within five percent, which is considered nominal.

**Nozzle:** The outlet from a faucet or hose so designed so that the issuing stream of water is thrown in a shape or size different from the diameter of the pipe.

**Panel Flange:** A type of mounting unity used where the back panel is constructed at a 90 degree angle to the table top.

**Particleboard:** A generic term for a panel manufactured from lignocellulosic material—commonly wood—essentially in the form of particles (as distinct from fibers) These materials are bonded together with synthetic resin or other suitable binder, under heat and pressure, by a process wherein the interparticle bonds are created wholly by added binder.

**Particulate Matter:** Small, light-weight particles that will be airborne in low velocity air [approximately 50 fpm (.25 m/s)].

**Pedal Valve:** A device used to operate valves by means of the foot, may be either single or double, floor, ledge or wall mounted.

**Pedestal:** See Turret.

**Permanent Damage:** Destruction to material or joinery that would require repair in order to return to its original state.

**Permanent Deformation:** Deflection that has exceeded the plastic limit, thus changing the original shape of the product.

**Permanent Deterioration:** Erosion or corrosion of material such that the components will never return to their original shape.

**Permanent Failure:** See “permanent damage”

**Pipe Support:** A rack of framework located in the service tunnel used to support the service lines.

**Pitot Tube:** Device used to measure air pressure differential, usually calibrated in inches of water.

**Plenum Chamber:** Chamber used to equalize air flow.

**Polyethylene:** A plastic polymer of ethylene used chiefly for containers, fittings and sinks.

**Polypropylene:** Material is a polyolefin which is generally high in chemical resistance. Material should conform to ASTM D-2146. This material is commonly used for acid waste piping as well as for deionized water.

**Polyvinyl Chloride (PVC):** A water insoluble, thermoplastic resin derived by the polymerization of vinyl chloride used chiefly for containers, fittings and piping.

**Polyvinylidene Fluoride (PVDF):** Material is a strong and abrasion resistant fluoropolymer. It is chemically resistant to most acids, bases and organic solvents, and is the preferred material for piping and faucets for ultra-pure water. Pure PVDF is an opaque white resin that is resistant to UV radiation, and is superior for non-contaminating applications.

**Positive Air Pressure:** Air pressure higher than ambient.

**Potable Water:** Water which is satisfactory for drinking, culinary and domestic purpose, and meets the requirements of the Health Authority having jurisdiction.

**Pressure Gauge:** Instrument for measuring the pressure of fluids, gases or air.

**Pressure Regulator:** Any device by means of which pressure may be regulated.
**Primary Outlet:** The outlet from the fitting on the discharge side of the valve, through which water will discharge unless diverted to another outlet.

**Proper Authorities:** The party(ies) designated by contract to approve additions, changes, or deletions to contracts, plans or specifications.

**Pulls:** Articles used to grasp the door or drawer (see also hardware).

**Quick Connect:** A device used in place of the serrated tip where quick connect and disconnect requirements are needed for water, air and non-corrosive gases.

**Rack Resistance:** The ability of a desk product to resist stresses that tend to make the product distort and the drawers become misaligned.

**Rail:** A bar extending from one side of the cabinet to the other.

**Reagent:** A substance used because of its chemical or biological activity.

**Reagent Rack:** A shelf, or shelves, provided at the back of wall assembly, or down the middle of center tables, island or peninsulas to provide storage for reagent bottles, with provision made for the support of mechanical or electrical service lines and service fittings as needed.

**Related Equipment:** Items not generally manufactured by the SEF supplier but furnished and/or installed as part of the SEF supplier’s contract. These may consist of, but are not limited to: instrumentation, environmental rooms, refrigeration systems, laboratory apparatus, etc.

**Remote Control Valves:** Valves usually installed in the walls of fume hoods with the control handles normally on the face of the hood which regulates and controls the flow of the services to the outlets in the interior of the fume hood.

**Removable Back:** A panel located on the inside back of the base cabinet which is removable in order to gain access to the plumbing area.

**Renewable Seat:** A seat in a valve which can be removed and replaced with a tool.

**Replaceable Interior Unit:** A cartridge type assembly containing all the working parts of a valve.

**Room Air:** That portion of the exhaust air taken from the room.

**Rough-Ins:** The location for the point of connection for plumbing, electrical, or mechanical services within the casework service tunnel/chase shall be located within fifteen feet (15’) or as stated by local codes, whichever is less, of the final fixture location.

**Rough-In Point:** Individual or common supply or mechanical, electrical and heating ventilating and air conditioning through wall, floor or ceiling, located within the equipment chase.

**Sash:** Moveable panel at the access opening.

**Scientific Equipment and Furniture Supplier (SEF Supplier):** Manufacturer, dealer, distributor or agents who provide laboratory furniture, equipment and fume hoods.

**Scribe:** A strip of matching material that is fitted to the wall on one edge and fastened to the casework on the other to make a tight enclosure when casework abuts the walls, column, etc.

**Scrubber, Fume:** A device used to remove contaminants from fume hood exhaust, normally utilizing water.

**Seat Disc:** A disc or washer which when compressed against the seat makes a water tight joint.

**Seat Faucet:** The surface around or within the orifice in the faucet through which water or other liquid flows and against which the closing member, such as stem washer, is pressed or seated to terminate the flow.

**Secondary Outlet:** Any outlet from the fitting other than primary outlet, on the discharge side of the valve through which water may be discharged.

**Self-Closing Faucet:** A faucet which closes automatically when the faucet handle is released.
**Serrated Tip (Nozzle):** An outlet straight or angled, of graduated serrations which will accommodate laboratory hoses used in experimentation.

**Service:** The supplying of utilities or commodities such as water, air, gas, vacuum, steam as required in hospital or laboratory functions.

**Service Fitting:** Any device designed to control and/or guide the flow of water, steam, vacuum or gases.

**Service Fittings and Fixtures:** Service fittings include oxygen, gas, air, vacuum, and steam cocks, turrets, hot, cold and distilled water faucets, remote controlled valves, filter pumps, vacuum breakers, eye washers, shower heads, steam cones and steam baths, sinks, cupsinks, traps and plaster traps. Service fixtures include electrical convenience outlet boxes, electrical pedestals, “C” type conduits, single or duplex A.C. or D.C. receptacles, switches, variable voltage units and fluorescent tubes.

**Service Fixture:** Item of laboratory plumbing mounted on or fastened to laboratory fume hood.

**Service Line:** Pipe or tubing used to convey the service, gas or liquid, from the building service line to the service fitting on the laboratory furniture or equipment.

**Service Tunnel or Service Chase:** Area in back of or between the backs of base cabinets and under the working surface provided to allow room for several lines.

**Service Turret:** An enclosure that projects above the table top to provide room for the service line to be brought up through the table top or be connected to the service fittings that are mounted on the outside surface of the enclosure.

**Service Umbilical:** A fully enclosed chase containing service lines extending from the ceiling area above the laboratory bench into the service tunnel of the same laboratory bench.

**Shall:** Where used indicates a mandatory feature.

**Shelving:** A flat surface fastened horizontally to a cabinet interior or a wall used to hold objects.

**Significant Surface:** A finished exposed surface which if marred would spoil the appearance of the fitting.

**Single Control Mixing Valve:** A fitting with a single control which shall serve to turn water on and off and to regulate volume and temperature of flow.

**Sink Outlet:** A flanged fitting that is recessed and sealed into the sink bottom to provide means of connecting sink to drainage system.

**Slot Velocity:** Speed of air moving through fume hood baffle openings.

**Smoke Candle:** Smoke-producing device used to allow visual observation of air flow.

**Spot Collector:** A small, localized ventilation hood usually connected by a flexible duct to an exhaust fan. This device is not a laboratory fume hood.

**Stainless Steel:** Iron based alloys containing more chromium than the 12% necessary to produce passivity (less reactive), but less than 30%.

**Standard Tools:** Tools, such as screw driver, key wrench, flat jawed wrench, pliers, which are normally carried by plumbers for the installation and maintenance of plumbing.

**Static Pressure:** Air pressure in laboratory fume hood or duct, usually expressed in inches of water.

**Static Pressure Loss:** Measurement of resistance created when air moves through a duct or hood, usually expressed in inches of water.

**Stops:** Valves used for the purpose of controlling the flow of water and which are part of the distributive plumbing system except as otherwise determined.

**Straight Stops:** See Straight Valves.

**Straight Valves:** Straightway valves used for laboratory services such as gas, air, water and steam which have their inlet and outlet port at position 180 degrees from each other.
Strength: Known variously as “modulus of rupture” or “flexural strength” and is an ultimate or breaking strength. Generally measured by supporting a strip of material across two supports and applying a load between these supports. By computation the strength values can be used to determine the load-carrying ability of the product and may be used to compare strengths of different products.

Submersion: Covered with water

Superstructure: The portion of a laboratory fume hood that is supported by the work surface.

Supplemental Air: Supply or auxiliary air delivered to a laboratory fume hood to reduce room air consumption.

Supply Nipple & Lock Nut: The threaded connecting units used for deck or panel mounting of laboratory fittings.

Supply Stops: Valve 3/4 or 1/2 inch I.P.S. or Copper inlet size or smaller for the purpose of controlling the flow of water and which are a part of the distributive plumbing system immediately adjacent to, or a part of, and preceding a fitting.

Tables: An article of furniture having a flat, horizontal surface supported by one or more support members (legs), and a frame (apron).

Table Top Hood: A small, spot ventilation hood for mounting on table tops. Used primarily in educational laboratories. This device is not a laboratory fume hood.

Tall Cabinet (Full Height Unit): A tall cabinet is a storage devise that consists of two ends, a back and a face. The face may be open to access the storage area or may be fitted with one or more drawers and/or door(s). A tall cabinet is always mounted on the floor and is nominally 84” (2,133.6mm) high.

Tail Piece: The connecting fitting used to connect the sink outlet to trap or drain line. Tail piece may be an integral part of the sink outlet or a separate piece.

Tank Nipple: See Supply Nipple.

Thermal Anemometer: A device for measuring fume hood velocity utilizing the principle of thermal cooling of a heated element as the detection element.

Thermal Shock: The ability of material to withstand sudden changes in temperature without cracking or spalling.

Threshold Limit Valve-Time Weighted Average (TLV-TWA): The time-weighted average concentration for a normal 8-hour workday or 40-hour week, to which nearly all workers may be repeatedly exposed, day after day, without adverse effect.

Titanium Tetrachloride: Chemical that generates white fumes used in testing laboratory fume hoods.

Torsion: The state of being twisted.

Total Pressure: Algebraic sum of velocity pressure and static pressure

Toxic Resistance: The ability of a top to withstand emission of a toxic substance, if any during chemical process.

Transport Velocity: Minimum speed of air required to support and carry particles in an air stream.

Turret: Type of mounting which allows the use of (1)-(2)-(3)-(4) hose cocks, needle hose cocks or straight stops, where installation of same are required either on the table top, back, or panel.

Uniformly Distributed: The application of forces such that weight is evenly applied to the subject surface even as the surface deflects.

Unobstructed Entry: A cabinet is deemed to be unobstructed if access to the entire storage area is completely without obstacle.

Upright Position: A cabinet oriented in its intended position.

Vacuum Breaker: A device to prevent the creation of a vacuum by admitting air at atmospheric pressure, used to prevent back siphonage.
Valve: A device by which the flow may be started, stopped, or regulated by a moveable part which opens or obstructs the passage.

Valve Seat: The port or ports against or into which a disc or tapered stem is compressed or inserted to stop flow of fluid or gas.

Velocity Pressure: Pressure caused by moving air in a laboratory fume hood or duct, usually expressed in inches of water.

Walk-In Hood: A floor-mounted, full-height fume hood, designed to accommodate tall apparatus and permit roll-in of instruments and equipment.

Wall Cabinet: A wall cabinet is a storage devise consisting of two ends, a back, a top, bottom, and a face. The face may be open to access the storage areas or may be outfitted with one or more door(s). The wall cabinet usually does not include a drawer. A wall cabinet is always mounted on a vertical surface such as a wall, a divider, panel or some other vertical structure. A wall cabinet is usually less than 48" (1,219.2mm) high.

Water: The liquid that descends from the clouds as rain; forms streams, lakes and seas; issues from the ground in springs, and is a major constituent of all living matter, and when pure, consists of an oxide of hydrogen H2O, in the proportion of two atoms of hydrogen to one atom of oxygen. It is an odorless, tasteless, very slightly compressible liquid which appears bluish in thick layers. Freezes at 0 degrees C. and boils at 100 degrees C., and has a maximum density of 4 degrees C. and a high specific heat, contains very small equal concentrations of hydrogen ions, reacts neutrally and constitutes a poor conductor of electricity, a good ionizing agent.

Water Absorption: The percentage gain in weight of material immersed in water for a specified time. When the specific gravity of the product is known, water absorption can be used to determine the total void space. The absorption is neither a measure of the rate nor amount of chemical attack.

Water Outlet: A water outlet, as used in connection with the water distributing system, is the discharge opening for the water.

Weather Cap: Device used at the top of an exhaust stack to prevent rain from entering the stack end.

Work Space: The part of the fume hood interior where apparatus is set up and fumes are generated. It is normally confined to a space extending from six inches (15.2 cm) (152mm) behind the plane of the sash(es) to the face of the baffle, and extending from the work surface to a place parallel with the top edge of the access opening.

Work Surface: The surface that a laboratory fume hood is located on and supported by a base cabinet. In the fume chamber the surface is recessed to contain spills.

Wrist Action Handle: A means of controlling a valve with the wrist or forearm.

Wye Fitting: Similar to double panel flange, but outlets are at 90 degrees or less.
Scientific Equipment & Furniture Association
Recommended Practices

SEFA 5-2010
SCOPE OF WORK

SEFA World Headquarters
65 Hilton Avenue
Garden City, NY 11530

Tel: 516-294-5424
Fax: 516-294-2758
www.sefalabs.com
## Table of Contents

<table>
<thead>
<tr>
<th>Sections</th>
<th>Page</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Foreword</td>
<td>142</td>
<td>3.5</td>
</tr>
<tr>
<td><strong>1.0 Glossary of Terms</strong></td>
<td>143</td>
<td></td>
</tr>
<tr>
<td>2.0 F.O.B. Origin</td>
<td>143</td>
<td>3.6</td>
</tr>
<tr>
<td>2.1 General Requirements</td>
<td>143</td>
<td>3.7</td>
</tr>
<tr>
<td>2.2 Standard of Quality</td>
<td>143</td>
<td></td>
</tr>
<tr>
<td>2.3 Conditions of Purchase</td>
<td>143</td>
<td>3.8</td>
</tr>
<tr>
<td>2.4 Equipment and Service</td>
<td>143</td>
<td></td>
</tr>
<tr>
<td>2.5 Equipment, Security</td>
<td>143</td>
<td>3.9</td>
</tr>
<tr>
<td>2.6 Drawings</td>
<td>143</td>
<td>3.10</td>
</tr>
<tr>
<td>2.7 Samples</td>
<td>143</td>
<td>3.11</td>
</tr>
<tr>
<td>2.8 Inspection</td>
<td>143</td>
<td>3.12</td>
</tr>
<tr>
<td>3.0 Delivered and</td>
<td>146</td>
<td></td>
</tr>
<tr>
<td>3.1 General Requirements</td>
<td>146</td>
<td>3.13</td>
</tr>
<tr>
<td>3.2 Standard of Quality</td>
<td>146</td>
<td>3.14</td>
</tr>
<tr>
<td>3.3 Conditions of Purchase</td>
<td>146</td>
<td>3.15</td>
</tr>
<tr>
<td>3.4 Equipment and Service</td>
<td>146</td>
<td>3.16</td>
</tr>
<tr>
<td>3.5 Equipment, Security</td>
<td>146</td>
<td>3.17</td>
</tr>
<tr>
<td>3.6 Drawings</td>
<td>146</td>
<td>3.18</td>
</tr>
<tr>
<td>3.7 Samples</td>
<td>146</td>
<td>3.19</td>
</tr>
<tr>
<td>3.8 Inspection</td>
<td>146</td>
<td>3.20</td>
</tr>
<tr>
<td>4.0 Delivered, Installed</td>
<td>149</td>
<td>4.1</td>
</tr>
<tr>
<td>4.1 General Requirements</td>
<td>149</td>
<td>4.2</td>
</tr>
<tr>
<td>4.2 Standards of Quality</td>
<td>149</td>
<td>4.3</td>
</tr>
<tr>
<td>4.3 Conditions of Purchase</td>
<td>149</td>
<td></td>
</tr>
<tr>
<td>4.4 Equipment and Service</td>
<td>149</td>
<td>4.5</td>
</tr>
<tr>
<td>4.5 Equipment, Security</td>
<td>149</td>
<td>4.6</td>
</tr>
<tr>
<td>4.6 Drawings</td>
<td>149</td>
<td></td>
</tr>
<tr>
<td>4.7 Samples</td>
<td>149</td>
<td>4.8</td>
</tr>
<tr>
<td>4.8 Inspection</td>
<td>149</td>
<td></td>
</tr>
</tbody>
</table>
Foreword

SEFA Profile

The Scientific Equipment and Furniture Association (SEFA) is an international trade association comprised of manufacturers of laboratory furniture, casework, fume hoods and members of the design and installation professions. The Association was founded to promote this rapidly expanding industry and improve the quality, safety and timely completion of laboratory facilities in accordance with customer requirements.

SEFA Recommended Practices

SEFA and its committees are active in the development and promotion of Recommended Practices having domestic and international applications. Recommended Practices are developed by the association taking into account the work of other standard-writing organizations. Liaison is also maintained with government agencies in the development of their specifications.

SEFA's Recommended Practices are developed in and for the public interest. These practices are designed to promote a better understanding between designers, architects, manufacturers, purchasers, and end-users and to assist the purchaser in selecting and specifying the proper product to meet the user's particular needs. SEFA's Recommended Practices are periodically updated. The Recommended Practices are numbered to include an annual suffix which reflects the year that they were updated.

SEFA Glossary of Terms

SEFA has developed a Glossary of Terms (SEFA 4-2010) for the purpose of promoting a greater understanding between designers, architects, manufacturers, purchasers and end users. The terms defined by SEFA are frequently used in contracts and other documents, which attempt to define the products to be furnished or the work involved. The Association has approved this Glossary in an effort to provide uniformity among those who use these terms. Where a specific Recommended Practice contains definitions which differ from those in the Glossary of Terms, then the definitions in the specific Recommended Practice should be used.

SEFA encourages all interested parties to submit additional terms or to suggest any changes to those terms already defined by the Association. The definitions should be used to help resolve any disputes that may arise or to incorporate the applicable terms in any contract or related documents.

SEFA Disclaimer

SEFA uses its best effort to promulgate Recommended Practices for the benefit of the public in light of available information and accepted industry practices. SEFA does not guarantee, certify, or assure the safety or performance of any products, components, or systems tested, installed, or operated in accordance with SEFA Recommended Practices or that any tests conducted under its Recommended Practices will be non-hazardous or free from risk. SEFA encourages the use of third party independent testing where appropriate.
1.0 Glossary of Terms

Customer: Can be any one or combination of these listed: Architect, Buyers, Contractors, Engineers, End Users, Specifying Engineers, Purchasers, Construction Managers or Owners.

Drain Line: The pipe or tubing used to connect the sink tail piece or trap to the building waste line.

Electrical Service Fixture: Outlet or other electrical device directly attached to the laboratory furniture and equipment.

Filler Panel: A panel used to close an open area between a unit and a wall or between two units.

Furnish: Supply to other contractors; not installed by Laboratory Furniture Equipment Manufacturer.

Integral Vacuum Breakers: A vacuum breaker which is formed as a unit with the faucet gooseneck.

Job Site: Physical location or building site where laboratory furniture is to be installed.

Knee Space Panel: A panel used to close the area under an apron, to enclose the plumbing space, or to shield the knee space area.

Laboratory Furniture and Equipment: The casework, fume hoods, work surfaces, sinks, fixtures, shelves, and associated hardware as detailed.

Pipe Support: A rack of framework located in the service tunnel used to support the service lines.

Reagent Rack: A shelf, or shelves, provided at the back of wall assembly, or down the middle of center tables, island or peninsulas to provide storage for reagent bottles, with provision made for the support of mechanical or electrical service lines and service fittings as needed.

Rough-Ins: The location for the point of connection for plumbing, electrical, or mechanical services within the casework service tunnel chase shall be located within fifteen feet (15') or as stated by local codes, whichever is less, of the final fixture location.

Service Fitting: Any device designed to control and/or guide the flow of water, steam, vacuum or gases.

Service Line: Pipe or tubing used to convey the service, gas or liquid, from the building service line to the service fitting on the laboratory furniture or equipment.

Service Strip: A rack or framework used to support the service line.

Service Tunnel or Service Chase: Area in back of or between the backs of base cabinets and under the working surface provided to allow room for several lines.

Service Turret: An enclosure that projects above the table top to provide room for the service line to be brought up through the table top or be connected to the service fittings that are mounted on the outside surface of the enclosure.

Service Umbilical: A fully enclosed chase containing service lines extending from the ceiling area above the laboratory bench into the service tunnel of the same laboratory bench.

Sink Outlet: A flanged fitting that is recessed and sealed into the sink bottom to provide means of connecting sink to drainage system.

Tail Piece: The connecting fitting used to connect the sink outlet to the trap or drain line. Tail piece may be an integral part of the sink outlet or a separate piece.

2.0 F.O.B. Origin

2.1 General Requirements

Laboratory furniture and equipment covered by this specification and accompanying drawings shall be supplied under the direction of one Laboratory Furniture and Equipment Contractor to eliminate any divided responsibility, unless specified to the contrary.
2.4 Equipment and Service Fixtures Supplied By Laboratory Furniture and Equipment Contractor

2.4.1 Furnish all laboratory furniture and equipment, tops, ledges and supporting structures, fume hoods, vented enclosures or vented devices and miscellaneous items of equipment as listed in this specification or equipment schedules or as specifically noted on drawings. Furnish all filler panels, knee space panels where specified, and scribes as shown. Laboratory furniture and equipment to be furnished as designed and properly marked for installation on job site by appropriate trades.

2.4.2 Furnish, packed in boxes for installation by trade contractor, laboratory sinks, drains, drain troughs, overflows, and sink outlets. These shall be furnished unassembled in properly marked cartons and turned over to the proper trade at the tailgate or single location designated by the Laboratory Furniture and Equipment Contractor. Traps, tailpieces and special coupling devices shall be provided by others.

2.4.3 Furnish, packed in boxes for installation by trade contractor, faucets and plumbing service supply fixtures to attach to the furniture or equipment as called for in the specifications, equipment list or shown on drawings, complete with tank nipples and lock nuts for mounting fixtures on tops or curbs. These shall be furnished unassembled in properly marked cartons and turned over to the proper trade at the tailgate or at a single location designated by the Laboratory Furniture and Equipment Contractor, for distribution, mounting and connection by the plumber. Integral vacuum breakers shall be furnished only as called for in the specifications and where these are part of the equipment as listed in the specifications, equipment schedule or shown on drawings.

2.4.4 Furnish electrical service fixtures directly attached to the casework or equipment as called for in the specifications, equipment list and/or shown on drawings. Fixtures shall be furnished unassembled, in cartons, properly marked and

Bidders must be prepared to provide within 10 days before opening of bids the following proof of their ability to perform under this contact. They have satisfied the project specifications for qualifications and experience (Usually three years experience and ten completed projects of comparable size and scope within the most recent three year period.)

Financial and technical resources of sufficient scope to assure prompt and satisfactory performance in the production and delivery of equipment specified so as not to delay the program of the work. Failure to meet any of these requirements and qualifications may be sufficient cause for the rejection of any or all bids, and to award the contract to other than the lowest bidder, if in the specifiers opinion, such action would insure better performance and a higher level of quality and value.

2.2 Standard Of Quality

It is the prime intent of this specification and applicable drawings to show and define the essential minimum requirements as to the quality of materials, construction, finish and overall workmanship. Furniture and/or equipment differing from that specified will not be considered unless ample proof is submitted with the proposal in the form of complete drawings and samples indicating all essential requirements of this specification are adhered to. The owner, or their designated representative, reserves the right to reject any quotation offering equipment which in his considered opinion does not meet the standard of quality established by the specification.

2.3 Conditions Of Purchase

F.O.B. origin, freight prepaid and added to invoice. The laboratory Furniture and Equipment Contractor shall prepay freight cost and include it as a separate invoice item. Customer accepts title and equipment at F.O.B point loaded onboard transportation vehicle. Customer is responsible for filing and collecting freight claims.
shall be turned over to the electrician at the tailgate of the transportation vehicle or at a single location designated by the Laboratory Furniture and Equipment Contractor for distribution, mounting, and connection by the electrician.

2.5.5 Furnish service strip supports, service tunnels, service turrets, supporting structures and reagent racks of type shown on details or specified. Furnish pipe supports as specified as shown on architectural drawings located to no more than for feet (4') between centers. Furnish service lines in reagent racks only when such service lines are specifically noted as part of the specification.

2.5.6 Furnish fume hood blowers only when specifically listed in this section of the specification, equipment schedule or drawings.

2.4.7 Furnish additional cabinet hardware accessories such as locks, label holders, base molding, etc., only when specifically called out to be furnished in this section of the specifications.

2.4.8 The manufacture of furniture or equipment shall be based upon field checked drawings under Section 2.6 Drawings.

2.4.9 Furniture and equipment shall be loaded under the direction of the Laboratory Furniture and Equipment Contractor's manufacturing plant into trucks which normally transport this type of equipment. Full truckload lots of furniture and equipment shall be packed, appropriately protected and shipped in a van and/or stipulated transportation. Less than truckload lots shall be crated, boxed or packed separately for protection, handling and minimum freight rates.

2.4.10 The Laboratory Furniture and Equipment Contractor will not assume responsibility for any aspect of the installation.

2.4.11 Glossary of Terms of SEFA are incorporated herein for reference.

2.4.12 Special Note to Other Sections:

It shall be the responsibility of the specifier to define the work indicated under preceding paragraphs 2.4.1 through 2.4.11, as all inclusive and representing the total obligation of the Laboratory Furniture and Equipment Contractor, and to make such reference in the General Conditions and in the Scope of Work applicable to all other sections.

2.5 Equipment, Security and Work “By Others” Shall Include But Not Be Limited To:

2.5.1 Providing all framing and reinforcement to walls, floors, and ceilings necessary to adequately support the equipment, and all bucks and plaster grounds required for proper and safe installation of equipment.

2.5.2 Furnishing and installation of rough-in to point stipulated in LFE supplier drawings of all service lines, drain lines, piping, system backflow prevention, vents, revents, steam fittings and special plumbing fixtures or piping to meet local codes even though not specifically called for in Laboratory and Furniture and Equipment Contractor's specifications and/or shown on drawings.

2.5.3 Furnishing, installing and connecting of all duct work from fume hoods, vented enclosures and vented devices to blowers and from blowers to final point of discharge to atmosphere.

2.5.4 Hoisting or elevator service at no charge to Laboratory Furniture and Equipment Contractor.

2.5.5 Furnishing fluorescent tubes, light bulbs, and any miscellaneous materials generally classified as maintenance or supply items.

2.5.6 Providing protection and security during and after laboratory furniture and equipment installation.

2.5.7 Receiving, distributing, unpacking, inventorying and installing all laboratory furniture and equipment tops, ledges and supporting structures, fume hoods, vented enclosures or vented devices and miscellaneous items of equipment as listed in this specification, or equipment as listed in this specification, or equipment schedules or as specifically noted on drawings including all filler panels, knee
space panels where specified, and scribes as shown on Laboratory Furniture and Equipment shop drawings in accordance with SEFA 2-2010, manufacturer's installation instructions and local codes and regulations. Provide dumpster and/or other waste disposal at no cost to Laboratory Furniture and Equipment Contractor.

2.5.8 Receiving, distributing, unpacking, inventorying, installing and connecting, ready for use, all laboratory sinks, drains, drain troughs, overflows, and sink outlets. Supply and install all traps, tail pieces and any special coupling devices.

2.5.9 Receiving, distributing, unpacking, inventorying, installing and connecting, ready for use, all faucets and plumbing service supply fixtures attached to the furniture or equipment as called for in the specifications, equipment list or shown on drawings.

2.5.10 Receiving, distributing, unpacking, inventorying, installing and connecting, ready for use, all electrical service fixtures and devices.

2.6 Drawings

The Laboratory Furniture and Equipment Contractor shall furnish the customer with three sets of shop drawings, which will cover all items described in the furniture and equipment schedule and/or as shown on the drawings. In addition, he shall supply, without charge, one set of as-built drawings.

The Laboratory Furniture and Equipment Contractor shall furnish the customer with three sets of rough-in drawings detailing the locations of sinks and sink outlets, gas valves, chases, service lines, drain lines, piping, system vacuum breakers and conduit.

Additional prints required shall be furnished at a nominal charge to the owner.

The customer shall furnish the Laboratory Furniture and Equipment Contractor verified building measurements, at the time of order or at the time specified by the Lab Furniture and Equipment Contractor, as they exist to insure the proper fitting of all items of equipment furnished by the contractor.

2.7 Samples

When requested by the customer, samples as specified shall be submitted and approval before proceeding with any of the work. Product samples will be the basis of evaluation and any samples which do not meet the quality standards of the architect’s specifications shall constitute a basis of rejection of the quotation. Samples shall clearly show the following:

1. Top Construction
2. Drawer Construction
3. Corner and Leg Construction
4. Cabinet Construction
5. Door Construction
6. Finish
7. Hardware
8. Service Fixtures
9. Sink Construction

Samples shall be held by the customer for the duration of the project as a means for comparison of products supplied. Customer shall furnish contractor with written sample approval.

2.8 Inspection

Furniture and equipment may be inspected by the customer at the Laboratory Furniture and Equipment Contractor's manufacturing plant at the customer's expense prior to shipment. Any equipment found not to be in accordance with the project documents, approved shop drawings and approved samples may be rejected. All rejected furniture and equipment must be promptly replaced or modified at no cost to the customer.

3.0 Delivered and Installed

3.1 General Requirements

Laboratory furniture and equipment covered by this specification and accompanying drawing shall be supplied under the direction of one Laboratory Furniture and Equipment Contractor to eliminate any divided responsibility, unless specified to the contrary.

Bidders much be prepared to provide within 10
days before opening of bids, the following proof of their ability to perform under this contract.

1. They have satisfied the project specifications for qualifications and experience. (Usually three years experience and ten completed projects of comparable size and scope within the most recent three year period.)

2. Financial and technical resources of sufficient scope to assure prompt and satisfactory performance in the production and delivery of equipment specified so as not to delay the progress of work.

Failure to meet any of these requirements and qualifications may be sufficient cause for the rejection of any or all bids, and to award contract to other than the lowest bidder if in the specifier’s opinion, such action would insure better performance and a higher level of quality and value.

3.2 Standard of Quality

It is the prime intent of this specification and applicable drawings to show and define the essential minimum requirements as to the quality of materials, construction, finish and overall workmanship. Furniture and/or equipment different from that specified will not be considered unless ample proof is submitted with the proposal in the form of completed drawings and samples indicating all essential requirements of the specification are adhered to. The owner, or their designated representative, reserves the right to reject any quotation offering equipment which in his considered opinion does not meet the standard of quality established by this specification.

3.3 Conditions of Purchase

The Laboratory Furniture and Equipment Contractor shall be fully responsible for shipping and shall bear shipping expense, retain title during transit and file freight damage claims as necessary. Title transfers to the buyer upon substantial completion.

3.4 Equipment and Service Fixtures Supplied By Laboratory Furniture and Equipment Contractor

3.4.1 Furnish, deliver and install all laboratory furniture and equipment, tops, ledges and supporting structures, fume hoods, vented enclosures or vented devices and miscellaneous items of equipment as listed in this specification, or equipment schedules or as specifically noted on the drawings. Furnish all filler panels, knee space panels where specified, and scribes as shown. Laboratory furniture and equipment to be furnished as designed and properly marked for installation on job site by Laboratory Furniture and Equipment Contractor.

3.4.2 Furnish and deliver, packed in boxes for installation by trade contractor, laboratory sinks, drains, troughs, overflows, and sink outlets. These shall be furnished unassembled in properly marked cartons and turned over to the proper trade at the tailgate or a single location designated by the Laboratory Furniture and Equipment Contractor. Traps, tail pieces and special coupling devices shall be provided by others.

3.4.3 Furnish and deliver to respective trades’ care and custody, packed in boxes for installation by trade contractor, faucets and plumbing services supply fixtures attached to the furniture or equipment as called for in the specifications, equipment list or shown on drawings, complete with tank nipples and lock nuts for mounting on tops or curbs. These shall be furnished unassembled in properly marked cartons and turned over to the proper trade at the tailgate or at a single location designated by the Laboratory Furniture and Equipment Contractor, for distribution mounting and connection by the plumber. Internal vacuum breakers shall be furnished only as called for in the specifications and where these are part of the equipment as listed in the specifications, equipment schedule or shown on drawings.

3.4.4 Furnish and deliver electrical service fixtures directly attached to the casework or equipment as called for in the specifications, equipment list and/or shown on drawings. Fixtures shall be furnished unassembled in
cartons, properly marked and shall be turned over to the electrician at the tailgate of the transportation vehicle or at a single location designated by the Laboratory Furniture and Equipment Contractor for distribution, mounting and connection by the electrician.

3.4.5 Furnish and deliver service strip supports, service tunnels, service turrets, supporting structures and reagent racks of type shown on details or specified. Furnish pipe supports as specified as shown on architectural drawings located no more than four feet (4’) between centers. Furnish service lines in reagent racks only when such service lines are specifically noted as part of this section of specifications.

3.4.6 Furnish and deliver fume hood blowers only when specifically listed in this section of the specifications, equipment schedule or drawings.

3.4.7 Furnish additional cabinet hardware accessories such as locks, label holders, base molding, etc. only when specifically called out to be furnished in this section of the specifications.

3.4.8 The manufacture of furniture or equipment shall be based upon field checked drawings under Section 3.6 Drawings.

3.4.9 Furniture and equipment shall be loaded under the direction of the Laboratory Furniture and Equipment Contractor’s plant into trucks, which normally transport this type of equipment. Full truckload lots of furniture and equipment shall be packed, appropriately protected and shipped in a van and/or stipulated transportation. Less than truck load lots shall be crated, boxed or packaged separately for protection, handling and minimum freight rates.

3.4.10 The Laboratory Furniture and Equipment Contractor assumes responsibility for installation, which shall be performed in accordance with SEFA 2-2010.

3.4.11 SEFA 4-2010 Glossary of Terms is incorporated herein by reference.

3.4.12 Special Note to Other Sections:

It shall be the responsibility of the specifier to define the work indicated under preceding paragraphs 3.4.1 through 3.4.11 as all inclusive and representing the total obligation of the laboratory furniture and equipment contractor, and to make such reference in the General Conditions and in the Scope of Work Applicable to all other sections.

3.5 Equipment, Security and Work “By Others” Shall Include But Not be Limited To

3.5.1 Providing all framing and reinforcement to walls, floors and ceiling necessary to adequately support the equipment, and all bucks and plaster ground required for proper and safe installation of equipment.

3.5.2 Furnishing and installing of rough-in to point stipulated in LFE supplier drawings of all service lines, drain lines, piping, system backflow prevention, conduit and wiring including GFI protection, vents, revents, steam fittings and special plumbing fixtures or piping to meet local codes even though not specifically called for in Laboratory Furniture and Contractor’s specifications and/or shown on drawings.

3.5.3 Furnishing, installing and connecting of all duct work from fume hoods, vented enclosures and vented devices to blowers and from blowers to final point of discharge to atmosphere. Blowers, when so specified to be furnished by Laboratory Furniture and Equipment Contractor, shall be handled and/or installed by others.

3.5.4 Hoisting or elevator service at no charge to Laboratory Furniture and Equipment Contractor.

3.5.5 Furnishing fluorescent tubes, light bulbs and any miscellaneous materials generally classified as maintenance or supply items.

3.5.6 Providing protection and security during and after laboratory furniture and equipment installation.

3.5.7 Providing dumpster and/or other waste disposal at no cost to the Laboratory and Equipment Contractor.
3.5.8 Receiving, distributing, unpacking, inventorying, installing and connecting ready for use all laboratory sinks, drains, drain troughs, overflows, and sink outlets. Supply and install all traps, tailpieces and any special coupling devices.

3.5.9 Receiving, distributing, unpacking, inventorying, installing and connecting ready for use all faucets and plumbing service supply fixtures attached to the furniture or equipment as called for in the specifications, equipment list or shown on drawings.

3.5.10 Receiving, distributing, unpacking, inventorying, installing and connecting ready for use all electrical service fixtures and devices.

3.6 Drawings

The Laboratory Furniture and Equipment Contractor shall furnish the customer with three sets of shop drawings, which will cover all items described in the furniture and equipment schedule and/or as shown on the drawings. In addition, he shall supply, without charge, one set of as-built drawings.

The Laboratory Furniture and Equipment Contractor shall furnish the customer with three sets of rough-in drawings detailing the locations of sinks and sink outlets, gas valves, chases, service lines, drain lines, piping, system vacuum breakers and conduit.

3.7 Samples

When requested by the customer, samples as specified shall be submitted and approved before proceeding with any of the work. Product samples will be the basis of evaluation and any samples which do not meet the quality standards of the architect’s specifications shall constitute a basis of rejection of the quotation. Sample shall clearly show the following:

1. Top Construction
2. Drawer Construction
3. Corner and Leg Construction
4. Cabinet Construction
5. Door Construction
6. Finish
7. Hardware
8. Service Fixtures
9. Sink Construction

The customer shall furnish the contractor with written sample approvals.

3.8 Inspection

Furniture and equipment may be inspected by the customer at the Laboratory Furniture and Equipment Contractor’s manufacturing plant and the customer’s experience prior to shipment. Any equipment found not to be in accordance with the project documents, approved shop drawings, and approved samples may be rejected. All rejected furniture and equipment must be promptly replaced or modified at no cost to the customer.

4.0 Delivered, Installed and Connected

4.1 General Requirements

Laboratory furniture and equipment covered by this specification and accompanying drawings shall be supplied under the direction of one Laboratory Furniture and Equipment Contractor to eliminate any divided responsibility, unless specified to the contrary.

Bidders must be prepared to provide within 10 days before opening of bids the following proof of their ability to perform under this contract:

They have satisfied the project specifications for qualifications and experience (Usually three years experience and ten completed projects of comparable size and scope within the most recent three year period.) sufficient scope to assure prompt and satisfactory performance in the production and delivery of equipment specified so as not to delay the progress of the work.

Failure to meet any of the requirements and qualifications may be sufficient cause for the rejection of any or all bids, and to award contract to someone other than the lowest bidder if, in the opinion of the specifier, such action would insure better performance and a high level of quality and value.
4.2 Standard of Quality

It is the prime intent of this specification and applicable drawings to show and define the essential minimum requirements as to the quality of materials, construction, finish and overall workmanship. Furniture and/or equipment differing from that specified will not be considered unless ample proof is submitted with the proposal in the form of complete drawings and samples indicating all essential requirements of the specifications are adhered to. The owner, or their designated representative, reserves the right to reject any quotation offering equipment which in his considered opinion does not meet the standard of quality established by the specifications.

4.3 Conditions of Purchase

The Laboratory Furniture and Equipment Contractor shall be fully responsible for shipping and shall bear shipping expense, retain title during transit, and file freight damage claims as necessary. Title transfers to the buyer upon substantial completion.

4.4 Equipment and Service Fixtures Supplied By the Laboratory Furniture and Equipment Contractor Shall Include:

4.4.1 Furnish, deliver and install all laboratory furniture and equipment, tops, ledges and supporting structures, fume hoods, vented enclosures or vented devices and miscellaneous items or equipment as listed in this specification, or equipment schedules or as specifically noted on drawings. Furnish all filler panels, knee space panels where specified, and scribes as shown. Laboratory furniture and equipment to be furnished as designed and properly marked for installation on job site by Laboratory Furniture and Equipment Contractor.

4.4.2 Furnish, deliver and install laboratory sinks, drains, drain troughs, overflows, and sink outlets. Traps, tailpieces and special coupling devices shall be provided by others.

4.4.3 Furnish, deliver and install faucets and plumbing service supply fixtures attached to the furniture or equipment as called for in the specifications, equipment list or shown on drawings, complete with tank nipples and lock nuts for mounting fixtures on tops or curbs. Integral vacuum breakers shall be furnished only as called for in the specification and where these are part of the equipment as listed in the specifications, equipment schedule or shown on drawings.

4.4.4 Furnish and deliver electrical fixtures directly attached to the casework or equipment as called for in the specifications, equipment list and/or shown on drawings. Devices shall be furnished unassembled, in cartons, properly marked and shall be turned over to the electrician at the tailgate of the transportation vehicle or at a single location designated by the Laboratory Furniture and Equipment Contractor for distribution, mounting, and connection by the electrician. Service boxes, pedestals shall be mounted in place ready for attachment of conduit.

4.4.5 Furnish, deliver and install service strip supports, service tunnels, service turrets, supporting structures and reagent racks of type shown on details or specified. Furnish pipe supports as specified and as shown on architectural drawings located no more than four feet (4') between centers. Furnish service lines in reagent rack only when such service lines are specifically noted as part of this section of specifications.

4.4.6 Furnish and deliver fume hood blowers only when specifically listed in this section of the specification, equipment schedule or drawings.

4.4.7 Furnish additional cabinet hardware accessories such as locks, label holders, base molding, etc., only when specifically called out to be furnished in this area of the specifications.

4.4.8 The manufacture of furniture or equipment shall be based upon field checked drawings under section 4.6 Drawings.

4.4.9 Furniture and equipment shall be loaded under the direction of the Laboratory Furniture and Equipment Contractor’s manufacturing plant into trucks which normally transports this type of equipment. Full truckload lots of furniture
and equipment shall be packed, appropriately protected and shipped in a van and/or stipulated transportation. Less than truckload lots shall be crated, boxed or packaged separately for protection, handling and minimum freight rates.

4.4.10 Glossary of terms of SEFA are incorporated herein by reference.

4.4.11 Special Note to Other Sections.
It shall be the responsibility of the Specifier to define the work indicated under preceding paragraphs of this section as all inclusive and representing the total obligation of the Laboratory Furniture and Equipment Contractor, and to make such reference in the General Conditions and in the Scope of Work applicable to all other sections.

4.5 Equipment, Security And Work “By Others” Shall Include But Not Be Limited To:

4.5.1 Providing all framing and reinforcement to walls, floors, and ceilings necessary to adequately support the equipment, and all bucks and plaster grounds required for proper and safe installation. Furnishing and installation of rough-in to point stipulated in LFE supplier drawings of all service lines, drain lines, piping, system backflow prevention, conduit and wiring including system GFI protection, vents, revents, steam fittings and special plumbing fixtures or piping to meet local codes, even though not specifically called for in Laboratory Furniture and Equipment Contractor’s specifications and/or shown on drawings.

4.5.2 Furnishing, installing and connection of all duct work from fume hoods, vented enclosures and vented devise to blowers and from blowers to atmosphere. Blowers when so specified to be furnished by Laboratory Furniture and Equipment Contractor, shall be handled and/or installed by others.

4.5.3 Hoisting or elevator service at no charge to Laboratory Furniture and Equipment Contractor.

4.5.4 Furnishing fluorescent tubes, light bulbs, and any miscellaneous material generally classified as maintenance or supply items.

4.5.5 Providing protection and security during and after laboratory furniture and equipment installation.

4.5.6 Providing dumpster and/or other waste disposal at no cost to Laboratory Furniture and Equipment Contractor.

4.5.7 Connecting ready for use all laboratory sinks, drains, drain troughs, overflows, sink outlets. Supply and install all traps, tailpieces and any special coupling devices.

4.5.8 Receiving and installing electrical devices and connecting, ready for use, all electrical service fixtures and devices.

4.6 Drawings
The Laboratory Furniture and Equipment Contractor shall furnish the customer with three sets of shop drawings, which will cover all items described in the equipment schedule and/or as shown on the drawings. In addition, he shall supply, without charge, one set of as-built drawings.

The Laboratory Furniture and Equipment Contractor shall furnish the Customer with three sets of rough-in drawings detailing the location of sinks and sink outlets, gas valves, chases, service lines, drain lines, piping, systems vacuum breakers and conduit.

Additional prints required shall be furnished as a nominal charge to the Owner.

The Customer shall furnish the Laboratory Furniture and Equipment Contractor verified building measurements, at time of order or at time specified by the Laboratory Furniture and Equipment Contractor, as they exist to insure the proper fitting of all items of equipment furnished by the Contractor.
4.7 **Samples**

When requested by the Customer, samples as specified shall be submitted and approved before proceeding with any of the work. Product samples will be the basis of evaluation and any samples which do not meet the quality standards of the architect's specifications shall constitute a basis of rejection of the quotation. Sample shall clearly show the following:

1. Top Construction  
2. Drawer Construction  
3. Corner and Leg Construction  
4. Cabinet Construction  
5. Door Construction  
6. Finish  
7. Hardware  
8. Service Fixtures  
9. Sink Construction

Samples shall be held by the Customer for the duration of the project as a means for comparison of products supplied.

The Customer shall furnish the Contractor with written sample approval.

4.8 **Inspection**

Furniture and equipment may be inspected by the Customer at the Laboratory Furniture and Equipment Contractor's manufacturing plant at the Customer's expense prior to shipment. Any equipment found not to be in accordance with the project documents, approved shop drawings, and approved samples may be rejected. All rejected furniture and equipment must be promptly replaced or modified at no cost to the Customer.
Scientific Equipment & Furniture Association
Recommended Practices

SEFA 7-2010
Laboratory Fixtures

SEFA World Headquarters
65 Hilton Avenue
Garden City, NY 11530

Tel: 516-294-5424
Fax: 516-294-2758
www.sefalabs.com
## Table of Contents

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Committee Members</td>
<td>157</td>
</tr>
<tr>
<td>Foreword</td>
<td>158</td>
</tr>
<tr>
<td><strong>Sections</strong></td>
<td></td>
</tr>
<tr>
<td>1.0 Scope</td>
<td>159</td>
</tr>
<tr>
<td>2.0 Purpose</td>
<td>159</td>
</tr>
<tr>
<td>3.0 References</td>
<td>159</td>
</tr>
<tr>
<td>4.0 Definitions</td>
<td>160</td>
</tr>
<tr>
<td>5.0 Materials and Finishes</td>
<td>163</td>
</tr>
<tr>
<td>5.1 Materials Used in Laboratory Fittings</td>
<td></td>
</tr>
<tr>
<td>5.2 Finishes for Laboratory Service Fixtures and Safety Equipment</td>
<td></td>
</tr>
<tr>
<td>5.2.1 Finish Types</td>
<td></td>
</tr>
<tr>
<td>5.2.2 Chrome Plated Finishes</td>
<td></td>
</tr>
<tr>
<td>5.2.2.1 Description of Chrome Plated Finishes</td>
<td></td>
</tr>
<tr>
<td>5.2.2.2 Performance Tests for Chrome Plated Finishes</td>
<td></td>
</tr>
<tr>
<td>5.2.3 Corrosion Resistant Finishes</td>
<td></td>
</tr>
<tr>
<td>5.2.3.1 Description of Corrosion Resistant Finishes</td>
<td></td>
</tr>
<tr>
<td>5.2.3.2 Performance Tests for Corrosion Resistant Finishes</td>
<td></td>
</tr>
<tr>
<td>6.0 Color Coding</td>
<td>166</td>
</tr>
<tr>
<td>7.0 General Requirements for Laboratory Service Fittings</td>
<td>166</td>
</tr>
<tr>
<td>7.1 Workmanship</td>
<td></td>
</tr>
<tr>
<td>7.2 Handling</td>
<td></td>
</tr>
<tr>
<td>7.3 Installation</td>
<td></td>
</tr>
<tr>
<td>7.3.1 Fitting Design</td>
<td></td>
</tr>
<tr>
<td>7.3.2 Field Installation</td>
<td></td>
</tr>
<tr>
<td>7.4 Threads and other Connections</td>
<td></td>
</tr>
<tr>
<td>7.4.1 Pipe Threads</td>
<td></td>
</tr>
<tr>
<td>7.4.2 Inlets for Sink Fittings</td>
<td></td>
</tr>
<tr>
<td>7.4.3 Solder Connections</td>
<td></td>
</tr>
<tr>
<td>7.5 Marking</td>
<td></td>
</tr>
<tr>
<td>7.5.1 Product Marking</td>
<td></td>
</tr>
<tr>
<td>7.5.2 Packaging</td>
<td></td>
</tr>
<tr>
<td>8.0 Water Faucets and Fittings</td>
<td>168</td>
</tr>
<tr>
<td>8.1 General Requirements</td>
<td></td>
</tr>
<tr>
<td>8.1.1 Working Pressures</td>
<td></td>
</tr>
<tr>
<td>8.1.2 Working Temperatures</td>
<td></td>
</tr>
<tr>
<td>8.2 Valve Construction</td>
<td></td>
</tr>
<tr>
<td>8.3 Goosenecks, Spouts and Outlet Fittings</td>
<td></td>
</tr>
<tr>
<td>8.3.1 General Construction</td>
<td></td>
</tr>
<tr>
<td>8.3.2 Packings</td>
<td></td>
</tr>
<tr>
<td>8.3.3 Outlets</td>
<td></td>
</tr>
<tr>
<td>8.4 Testing</td>
<td></td>
</tr>
<tr>
<td>8.4.1 Strength Tests</td>
<td></td>
</tr>
<tr>
<td>8.4.1.1 Burst Strength Test</td>
<td></td>
</tr>
<tr>
<td>8.4.1.2 Bending Loads on Fittings</td>
<td></td>
</tr>
<tr>
<td>8.4.1.3 Spout Strength Test</td>
<td></td>
</tr>
<tr>
<td>8.4.2 Handle Security Test</td>
<td></td>
</tr>
<tr>
<td>8.4.3 Valve Operating Test</td>
<td></td>
</tr>
<tr>
<td>8.4.4 Life Tests</td>
<td></td>
</tr>
<tr>
<td>8.4.4.1 Life Tests for Valves</td>
<td></td>
</tr>
<tr>
<td>8.4.4.2 Life Test for Goosenecks and Spouts</td>
<td></td>
</tr>
<tr>
<td>8.4.5 High Temperature Extreme Test</td>
<td></td>
</tr>
<tr>
<td>8.4.6 Intermittent Shock Test</td>
<td></td>
</tr>
<tr>
<td>9.0 Fittings for Natural Gas, Air, Vacuum, Special Gases and Steam Services</td>
<td>171</td>
</tr>
<tr>
<td>9.1 Valve Types, Applications</td>
<td></td>
</tr>
<tr>
<td>9.1.1 Ground Key Cock Valves</td>
<td></td>
</tr>
<tr>
<td>9.1.2 Laboratory Ball Valves</td>
<td></td>
</tr>
</tbody>
</table>

© SEFA - 5th Edition Desk Reference - Version 2.0
<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>9.1.3 Needle Valves</td>
<td></td>
</tr>
<tr>
<td>9.1.4 Steam Valve</td>
<td></td>
</tr>
<tr>
<td>9.2 Valves for Burning Gases</td>
<td></td>
</tr>
<tr>
<td>9.2.1 Valve</td>
<td></td>
</tr>
<tr>
<td>9.2.2 Certification</td>
<td></td>
</tr>
<tr>
<td>9.3 Mounting Fittings</td>
<td></td>
</tr>
<tr>
<td>9.4 Valves and Pressure Regulators for High Purity Gases</td>
<td></td>
</tr>
<tr>
<td>9.4.1 General</td>
<td></td>
</tr>
<tr>
<td>9.4.2 Valves and Pressure Regulators for 5.0 Gases</td>
<td></td>
</tr>
<tr>
<td>9.4.3 Valves and Pressure Regulators for 6.0 Gases</td>
<td></td>
</tr>
<tr>
<td>10.0 Valves and Outlets for Use in Fume Hoods</td>
<td></td>
</tr>
<tr>
<td>10.1 Valve Types</td>
<td></td>
</tr>
<tr>
<td>10.1.1 Rod-Type Valves</td>
<td></td>
</tr>
<tr>
<td>10.1.2 Panel Mounted Valves</td>
<td></td>
</tr>
<tr>
<td>10.2 Valve Construction</td>
<td></td>
</tr>
<tr>
<td>10.3 Outlet Fittings</td>
<td></td>
</tr>
<tr>
<td>10.3.1 General Construction</td>
<td></td>
</tr>
<tr>
<td>10.3.2 Corrosion Resistance</td>
<td></td>
</tr>
<tr>
<td>10.3.3 Color Coding</td>
<td></td>
</tr>
<tr>
<td>10.4 Vacuum Breakers for Use on Fume Hoods</td>
<td></td>
</tr>
<tr>
<td>10.5 Installation</td>
<td></td>
</tr>
<tr>
<td>11.0 Faucets for Purified Water</td>
<td></td>
</tr>
<tr>
<td>11.1 General</td>
<td></td>
</tr>
<tr>
<td>11.2 Fitting Materials and Construction</td>
<td></td>
</tr>
<tr>
<td>12.0 Backflow Prevention</td>
<td></td>
</tr>
<tr>
<td>12.1 General</td>
<td></td>
</tr>
<tr>
<td>13.0 Fittings for ADA Compliance</td>
<td></td>
</tr>
<tr>
<td>14.0 Vandal-Resistant Fittings</td>
<td></td>
</tr>
<tr>
<td>14.1 Resistance to Physical Abuse</td>
<td></td>
</tr>
<tr>
<td>14.2 Protection of Supply Lines</td>
<td></td>
</tr>
<tr>
<td>14.3 Maintenance</td>
<td></td>
</tr>
<tr>
<td>15.0 Electrical Fittings</td>
<td></td>
</tr>
<tr>
<td>16.0 Emergency Eye Wash and Shower Equipment</td>
<td></td>
</tr>
<tr>
<td>16.1 General Requirements</td>
<td></td>
</tr>
<tr>
<td>16.2 Materials and Finishes</td>
<td></td>
</tr>
<tr>
<td>Appendix</td>
<td></td>
</tr>
</tbody>
</table>
SEFA 7 Laboratory Fixtures Committee Members

Co-Chairs

Mike Straughn - Water Saver Faucet
Dave Withee - BROENLAB A/S

BROENLAB A/S
Chicago Faucet Co.
Flad Architects
Rotarex
Scientific Plastics
Staubli
Vacuubrand
Water Saver Faucet Co.
Foreword

SEFA Profile

The Scientific Equipment and Furniture Association (SEFA) is an international trade association comprised of manufacturers of laboratory furniture, casework, fume hoods and members of the design and installation professions. The Association was founded to promote this rapidly expanding industry and improve the quality, safety and timely completion of laboratory facilities in accordance with customer requirements.

SEFA Recommended Practices

SEFA and its committees are active in the development and promotion of Recommended Practices having domestic and international applications. Recommended Practices are developed by the association taking into account the work of other standard-writing organizations. Liaison is also maintained with government agencies in the development of their specifications.

SEFA's Recommended Practices are developed in and for the public interest. These practices are designed to promote a better understanding between designers, architects, manufacturers, purchasers, and end-users and to assist the purchaser in selecting and specifying the proper product to meet the user's particular needs. SEFA's Recommended Practices are periodically updated. The Recommended Practices are numbered to include an annual suffix which reflects the year that they were updated. SEFA encourages architects to specify these Recommended Practices as follows: “SEFA 7-2010”.

SEFA Glossary of Terms

SEFA has developed a Glossary of Terms (SEFA 4-2010) for the purpose of promoting a greater understanding between designers, architects, manufacturers, purchasers and end users. The terms defined by SEFA are frequently used in contracts and other documents, which attempt to define the products to be furnished or the work involved. The Association has approved this Glossary in an effort to provide uniformity among those who use these terms. Where a specific Recommended Practice contains definitions which differ from those in the Glossary of Terms, then the definitions in the specific Recommended Practice should be used.

SEFA encourages all interested parties to submit additional terms or to suggest any changes to those terms already defined by the Association. The definitions should be used to help resolve any disputes that may arise or to incorporate the applicable terms in any contract or related documents.

SEFA Disclaimer

SEFA uses its best effort to promulgate Recommended Practices for the benefit of the public in light of available information and accepted industry practices. SEFA does not guarantee, certify, or assure the safety or performance of any products, components, or systems tested, installed, or operated in accordance with SEFA Recommended Practices or that any tests conducted under its Recommended Practices will be non-hazardous or free from risk. SEFA encourages the use of third party independent testing where appropriate.

Note: Testing as described in this document must be performed and documented by a SEFA-approved third party testing facility. See Page 34 of the SEFA Desk Reference 5th Edition Version 2.0, or visit us at SEFALABS.COM for the most current list of SEFA-approved test labs.
1.0 Scope

These Recommended Practices apply to (i) laboratory service fittings and fixtures, including faucets, valves and related products, and (ii) safety equipment, consisting of emergency eye washes, emergency showers and related products.

2.0 Purpose

SEFA has developed and made available these Recommended Practices as a guide for regulatory agencies, architects, engineers, consultants, specification writers, contractors, manufacturers and dealers of laboratory furniture, installers, facilities managers and users who specify, recommend for purchase, install and/or use laboratory service fittings and safety equipment. It is intended to provide the laboratory community with the most suitable products for dependable performance and safe sanitary installations. Specific construction features of the products covered by these Recommended Practices have not been considered.

3.0 References

“Plumbing Fixture Fittings”, ASME A112.18.1-2005

“Standard Specification for Copper Alloys in Ingot Form”, ASTM B30-04

“Standard Specification for Copper and Copper Alloy Forging Rod, Bar, and Shapes”, ASTM B124 / B124M-04


“Standard Specification for Free-Cutting Brass Rod, Bar and Shapes for Use in Screw Machines”, ASTM B16 / B16M-05

“Standard Specification for Seamless Copper Water Tube”, ASTM B88-03

“Standard Specification for Aluminum and Aluminum-Alloy Bar, Rod, and Wire”, ASTM B211-03


“Standard Test Methods for Measuring Adhesion by Tape Test”, ASTM D3359-02


“Standard Specification for Polypropylene Injection and Extrusion Materials”, ASTM D4101


“Performance Requirements for Atmospheric Type Vacuum Breakers”, ASSE 1001-2002

“Performance Requirements for Laboratory Faucet Backflow Preventers”, ASSE 1035-2002


“Uniform Plumbing Code”, IAPMO/ANSI UPC 1-2003
4.0 Definitions

Accessory - A component that can, at the discretion of the user, be readily added, removed, or replaced, and that, when removed, will not prevent the fitting from fulfilling its primary function. Includes outlet fittings such as serrated hose ends, aerators and aspirators.

Air Gap - The unobstructed vertical distance through the free atmosphere between the lowest opening from any pipe or faucet supplying water to a tank, plumbing fixture or other device and the mounting surface of the fitting.

Aerator - A type of outlet fitting that is designed to deliver a mixture of air and water. An aerator may incorporate an internal flow control to deliver water at a specific rate (usually specified in gallons or liters per minute).

Angle Pattern Valve - A valve that has its inlet port and outlet port at 90° to each other, with the operating stem at 180° to the inlet port.

Aspirator - A type of outlet fitting that, when water is passed through it, develops a vacuum through a side port. Also referred to as a "filter pump".

Atmospheric Vacuum Breaker - A device containing a float check, a check seat and an air inlet port. The flow of water into the body causes the float to close against the air inlet port. When the flow of water stops, the float falls and forms a check valve against back siphonage and at the same time opens the air inlet port to allow air to enter and relieve the vacuum.

Ball Valve - A type of valve used for controlling water or gases. The valve operates by means of a spherical "ball" that is positioned between two seals that are within a body housing and press against the ball to form a watertight or gastight seal. Rotation of the ball 90 degrees opens and closes the valve.

Celcon® - An acetyl copolymer.

Check Valve - A valve that permits flow in one direction only. The valve is designed to close automatically to retard or obstruct the flow in a reverse direction.

Cold Water - For test purposes, water at a temperature of 40°F to 70°F (5°C to 21°C)

Combination Fitting or Faucet - A supply fitting with more than one supply inlet delivering a mixture of hot and cold water through a single spout. May also be referred to as a "mixing faucet."

Critical Level - The level at which polluted water, entering through an outlet of the supply fitting, will flow back to the supply lines by gravity and/or any pressure below atmospheric in the supply line when the water control valve is wide or fully open.

Deck Mounted Fitting - A fitting that mounts on a horizontal surface.

Diaphragm or Bellows Valve - A type of valve that utilizes a diaphragm or bellows to separate the operating components of the valve (such as the valve stem and bonnet) from the areas through which the gas flows through the valve. The purpose of this type of valve is to prevent permeation of atmospheric impurities into the gas flowing through the valve. These valves are sometimes also referred to as "packless" valves.

Effective Waterway (Opening) - The minimum cross-sectional area at the point of water supply discharge, measured or expressed in terms of (i) the diameter of a circle, or (ii) if the opening is not circular, the diameter of a circle of equivalent cross-section area.

Fitting - A device designed to control and/or guide the flow of water, gases, vacuum or steam. Also referred to as a "service fitting".

Faucet - A device designed to control and/or guide the flow of water. A faucet generally incorporates some type of gooseneck or spout.

Fixture - In the plumbing industry, a fixture refers to a sink or receptacle that receives water or water-borne wastes and discharges into a drainage system. However, in the laboratory field, the term "fixture" has been used to describe a fitting or service fitting. Also referred to as a
“laboratory fixture”, “service fixture” or “laboratory service fixture.”

**Flange** - A type of mounting fitting generally used to hold a valve perpendicular to a wall or other vertical surface. May also be referred to as a “panel flange.”

**Flood Level Rim** - The top edge of a receptor over which water would overflow.

**Foot Operated Valve** - A valve for water service that is operated by the user’s foot. The valve may be either single or mixing and may be mounted on the floor, a ledge or a wall. Also referred to as a “pedal valve.”

**Front Loaded Remote Control Valve** - A valve for use on a fume hood that is installed on the front face or post of the fume hood. The valve is usually designed so that the working components of the valve are accessible from the front exterior face of the hood. Also referred to as a “panel mounted remote control valve.”

**Fuel Gas** - A gas that can be burned to supply heat. In laboratory applications, fuel gas generally refers to natural gas.

**Gas** - In laboratory applications, may refer to either fuel gas or to other substances in a gaseous state, such as nitrogen, helium, argon and oxygen. These latter gases may also be referred to as “special gases” or “cylinder gases.”

**Gas Purity** - The purity of a gas is a function of the quantity of impurities present in a sample of the gas. A gas that is 99.999% pure has .001% impurities in it. A gas that is 99.998% pure has .002% impurities in it.

Gas purity may also be designated by a two digit code. The first digit of the code represents the “number of nines” in the percentage value designating the purity of the gas and the second digit indicates the last decimal digit, if it is smaller than “nine”. For example, a gas that is 99.999% pure is referred to as being a “5.0” gas. A gas that is 99.998% pure is referred to as being a “4.8” gas.

**Ground Key Cock** - A type of valve used for controlling low pressure gases. The valve operates by means of a tapered cylindrical plug that fits into a matching tapered bore in the valve body. The tapered plug is ground and lapped and held in the valve body under continuous pressure to form a gastight seal in the valve body. Rotation of the tapered plug 90 degrees opens and closes the valve.

**Gooseneck** - A component of a faucet, usually fabricated of pipe or tubing and usually in the shape of the letter U, whose function is to direct the flow of water into a sink or receptor. Goosenecks may be of the rigid, swing or convertible rigid/swing type and may incorporate a vacuum breaker.

**High Purity Gases** - Any gas that has a level of purity or chemical composition that is certified as high purity by the gas manufacturer. For purposes of these Recommended Practices, high purity gases are gases with a certified purity level of 5.0 or greater (see definition of “gas purity” above).

**Index Button** - An indicator fitted into the top surface of the handle of a fitting that serves to identify the media or service being supplied by the fitting. For standards for color coding and symbols of services, refer to Section 6.

**Manifold** - A pipe or tube on which multiple fittings or outlets are mounted in parallel, relatively close together. On a typical manifold, one end is connected to a supply and the other end is plugged.

**Manual Control** - A type of valve mechanism wherein, once the valve is opened, the valve remains open until it is manually closed. Also referred to as “compression control.”

**May** - When used, indicates an alternate requirement or option.

**Mixing Valve, Faucet or Fitting** - A valve or faucet designed to mix hot and cold water by means of automatic or manual regulation.

**Mixing Valve, Single Control** - A fitting with a single handle or control that shall serve to turn water on and off, and to change volume and temperature by means of a single handle.
Monel - An alloy of approximately 67% nickel, 28% copper and 5% other elements that is made by direct reduction from ore in which the constituent metals occur in these proportions.

Mounting Fitting - A fitting used to install or mount a valve on a horizontal or vertical surface. Examples of mounting fittings include turret bases, panel flanges and wye fittings.

Mounting Shank - A threaded length of pipe used for securing a fitting to a horizontal or vertical surface and to supply water, gas or other media to the fitting. The pipe should be machined with a taper pipe thread to connect to the fitting, a straight pipe thread for a locknut and either a straight or taper pipe thread to connect to the supply line. The mounting shank should be supplied by the manufacturer with a locknut and lockwasher. Also referred to as a “supply nipple” or “tank nipple.”

Needle Valve - A type of valve in which an orifice is opened or closed by means of a needle or cone that is moved into or withdrawn from it.

Nipple - A short piece of pipe that is threaded at both ends.

Outlet Fitting - An accessory that is installed in the outlet end of a fitting.

Pedestal - See Turret Base.

Polyethylene (PE) - A plastic polymer of ethylene.

Polypropylene (PP) - Any of various thermoplastic plastics that are polymers of propylene.

Polyvinyl Chloride (PVC) - A water insoluble, thermoplastic material derived by the polymerization of vinyl chloride.

Polyvinylidene Flouride (PVDF) - A fluoropolymer that is chemically resistant to most acids, bases and organic solvents.

Potable Water - Water that is satisfactory for drinking, culinary, and domestic purposes, and meets the requirements of the health authority having jurisdiction.

Pressure Gauge - An instrument that measures and indicates the pressure of a liquid or gas.

Pressure Regulator - A device that regulates the pressure of a liquid or gas that is delivered through it.

Push/Turn Valve - A type of valve that has a handle that locks in the closed position and must be pushed down to permit the handle to rotate to open the valve. The internal construction of the valve shall incorporate rotating ceramic discs or other type of valve mechanism suitable for the intended use. Push/turn valves are generally used for natural and other burning gases.

Quick Connect - A fitting consisting of a body and a plug that interlock together to form a watertight or gastight connection. The body and plug may each have an internal valve to shut off the supply line when the two components are disconnected. The body and plug may also be keyed to form a matched set. Also referred to as a “quick disconnect.”

Remote Control Valve - A type of valve for use in a fume hood, where the handle of the valve is located on the outside of the hood (generally on the front face or post of the hood or underneath the hood). A remote control valve is usually connected to an outlet fitting that is installed within the interior of the fume hood. A remote control valve can be either a rod-type valve or a front loaded valve (see definitions).

Renewable Unit - A cartridge or unit that contains all of the working components of a valve and can be removed from the fitting body and replaced without disturbing the fitting body. Also referred to as a “replaceable unit.”

Rod-Type Remote Control Valve - A type of remote control valve where the valve is mounted within the side wall or underneath the fume hood. The valve is fitted with an extension rod that projects from the valve through the face of the hood or through the apron underneath the hood and a handle is mounted on the end of the rod.

Seat - The surface around or within an orifice in a faucet or valve through which water or gas flows and against which a closing member, such as a
disc or washer, is pressed or seated to terminate the flow. Also referred to as a “valve seat.” A “renewable seat” is a seat that is separate from the valve body and can be removed and replaced, either with or without a tool.

Seat Disc - A disc or washer that, when compressed against a seat, provides a watertight or gastight seal. Also referred to as a “valve disc” or “bib washer”.

Self-Closing Control - A type of valve mechanism that closes automatically when the handle is released.

Serrated Hose End - An outlet fitting that has graduated serrations that will accommodate hose or tubing. Also referred to as a “serrated nozzle” or “serrated tip.”

Service - The supplying of utilities such as water, air, gas, vacuum and steam as required in a laboratory. “Service” or “media” also refers to the specific liquid or gas that is delivered by a particular fitting.

Service Fitting - Any device that controls and/or guides the flow of a service in a laboratory.

Shall - Where used, indicates a mandatory requirement.

Single Valve, Faucet or Fitting - When used with reference to a water fitting, a fitting that delivers either cold, hot or tempered water only, without the capability of mixing the water.

Significant Surface - An exposed surface that, if marred, would detract from the appearance of the fitting.

Standard Tools - Tools, such as a screwdriver, key wrench, flat jawed wrench, strap wrench and pliers, which are normally carried by plumbers for the installation and maintenance of plumbing.

Straight Pattern Valve - A valve that has its inlet port and outlet port at 180° to each other, with the operating stem at 90° to the inlet port.

Turret or Turret Base - A type of mounting fitting, usually cylindrical in shape, used to install one or more fittings on a horizontal or vertical surface. The fittings are held parallel to the surface on which the turret base is installed.

Vacuum Breaker - A device to prevent the creation or formation of a vacuum in a piping system by admitting air at atmospheric pressure. A vacuum breaker is used to prevent back siphonage. A vacuum breaker used on a laboratory faucet may be either an atmospheric vacuum breaker (as defined above) or a laboratory faucet vacuum breaker having two independent acting check valves.

Valve - A device or fitting by which flow may be started, stopped or regulated by a movable part that opens or obstructs one or more passages.

Water - The liquid that descends from the clouds as rain, forms streams, lakes and seas, and is a major constituent of all living matter and that is an odorless, tasteless, very slightly compressible liquid oxide of hydrogen which appears bluish in thick layers, freezes at 0 C and boils at 100 C, has a maximum density at 4 C and a high specific heat, is feebly ionized to hydrogen and hydroxyl ions, and is a poor conductor of electricity and a good solvent.

Wrist Blade Handle - A handle that permits the control of a faucet with the wrist or forearm.

Wye Fitting - A type of mounting fitting that is similar to a panel flange except with two outlets.

5.0 Materials and Finishes

5.1 Materials Used in Laboratory Fittings

All materials used in laboratory service fittings shall be of the highest quality, shall be suitable for the intended use and shall meet or exceed the applicable standards listed below:

Brass Castings. Red brass castings shall be made of commercial red brass alloy conforming to ASTM Specification B30-04, C/Metal alloy, having a nominal composition of 81% copper.

Seamless Brass Tube. Seamless brass tubing shall conform to ASTM Specification B135-74, Alloy No. 280, having a nominal composition of 60% copper.

Seamless Red Brass Pipe. Seamless red brass pipe in standard sizes shall conform to ASTM Specification B43-74, having a nominal composition of 84 to 86% copper.

Free-Cutting Brass Rod, Bar & Shapes for Use in Screw Machines. Components fabricated of free-cutting brass rod, bar and shapes for use in screw machines shall conform to ASTM Specification B16-74, having a nominal composition of 60 to 63% copper.

Aluminum Castings. Aluminum castings shall conform to ASTM Specification B26-74, Alloy No. SG70A, having a chemical composition of 0.25% maximum copper, 0.6% maximum iron, 6.5% to 7.5% range silicon, 0.35% maximum manganese, 0.20% to 0.40% range magnesium, 0.35% maximum zinc, 0.25% maximum titanium, 0.15% maximum total other, and balance aluminum.

Aluminum Rod, Bar, Tube and Shapes. All components fabricated of aluminum rod, bar, tube, and shapes shall conform to ASTM Specification B211-74, Alloy No. 6061-T6, having a nominal composition of 1.0% magnesium, 0.6% silicon, 0.25% chromium, 0.25% copper, and balance aluminum.

Polypropylene. All components fabricated of polypropylene shall be non-pigmented and conform to ASTM Specification D4104.

5.2 Finishes for Laboratory Service Fixtures and Safety Equipment

5.2.1 Finish Types

The finish on laboratory service fittings and safety equipment shall be categorized as either a (i) chrome plated finish, or (ii) a corrosion resistant coated finish. Other types of finishes are not recommended for use in a laboratory environment.

5.2.2 Chrome Plated Finishes

5.2.2.1 Description of Chrome Plated Finishes

Chrome plated finishes shall consist of either (i) a layer of chromium applied over a layer of nickel applied over a layer of copper that is applied over all exposed surfaces of the components of the fitting itself, or (ii) a layer of chromium applied over a layer of nickel that is applied over all exposed surfaces of the components of the fitting itself. Chrome plated finishes shall be applied in conformance with “Standard Specifications for Electrodeposited Coatings of Copper Plus Nickel Plus Chromium and Nickel Plus Chromium”, ASTM B456-03. Finishes shall meet the requirements for Service Condition No. SC 4 (Very Severe Service) for nickel plus chromium coatings on copper or copper alloys.

5.2.2.2 Performance Tests for Chrome Plated Finishes

Chrome plated finishes shall meet the requirements for adhesion as specified in “Standard Practice for Qualitative Adhesion Testing of Metallic Coatings”, ASTM B571-97. The applicable tests shall be the (i) burnishing test, (ii) chisel-knife test, (iii) file test, and (iv) peel test.

5.2.3 Corrosion Resistant Finishes

5.2.3.1 Description of Corrosion Resistant Finishes

Corrosion resistant finishes shall be an organic coated finish applied to all exposed surfaces of the fitting. The finish may be either colored or clear. Coating material shall be either epoxy, epoxy/polyester hybrid, or polyester. Corrosion resistant finish can be applied as either a wet finish or a dry, powder coated finish. In either case, following application of the coating material, the fitting shall be baked to cure the coating material.

5.2.3.2 Performance Tests for Corrosion Resistant Finishes

Corrosion resistant finishes shall meet the following tests:
a. **Fume Test.**

Prepare samples of fittings having the corrosion resistant finish to be tested. Suspend samples in a container at least 6 cubic feet capacity, approximately 12” above open beakers, each containing 100 cc of 70% nitric acid, 94% sulfuric acid and 35% hydrochloric acid, respectively. After exposure to the fumes from these reagents for 150 hours, the finish shall show no discoloration, disintegration or other effects.

b. **Direct Application Test**

Prepare samples of flat brass panels with the corrosion resistant finish to be tested. The test shall consist of direct application of the reagents listed below.

**Test Method A** — For volatile chemicals, chemical spot tests shall be made by placing a cotton ball saturated with the reagent on the surface to be tested and covering with an inverted two-ounce wide mouth bottle to retard evaporation.

**Test Method B** — For nonvolatile chemicals, chemical spot tests shall be made by applying five (5) drops of each reagent to the surface to be tested and covering with a 1 1/4” diameter watch glass (concave side down) to confine the reagent.

All spot tests shall be conducted in such a manner that the test surface is kept wet throughout the entire test period and at a temperature of 77° F ± 3° F. For both methods, leave the reagents on the panel for a period of one hour. At the end of the test period, (i) the reagents shall be flushed from the surface with water, (ii) the surface shall be scrubbed with a soft bristle brush under running water, and (iii) the surface shall be rinsed and dried. Immediately prior to evaluation, 16 to 24 hours after the reagents are removed, the test surface shall be scrubbed with a damp towel and dried.

Note: Where concentrations are indicated, percentages are by weight

Test Evaluation: Evaluation of test results shall be based on the following rating system:

<table>
<thead>
<tr>
<th>Test No.</th>
<th>Chemical Reagent</th>
<th>Test Method</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Acetate, Amyl</td>
<td>A</td>
</tr>
<tr>
<td>2.</td>
<td>Acetate, Ethyl</td>
<td>A</td>
</tr>
<tr>
<td>3.</td>
<td>Acetic Acid, 98%</td>
<td>B</td>
</tr>
<tr>
<td>4.</td>
<td>Acetone</td>
<td>A</td>
</tr>
<tr>
<td>5.</td>
<td>Acid Dichromate, 5%</td>
<td>B</td>
</tr>
<tr>
<td>6.</td>
<td>Alcohol, Butyl</td>
<td>A</td>
</tr>
<tr>
<td>7.</td>
<td>Alcohol, Ethyl</td>
<td>A</td>
</tr>
<tr>
<td>8.</td>
<td>Alcohol, Methyl</td>
<td>A</td>
</tr>
<tr>
<td>9.</td>
<td>Ammonium Hydroxide, 28%</td>
<td>B</td>
</tr>
<tr>
<td>10.</td>
<td>Benzene</td>
<td>A</td>
</tr>
<tr>
<td>11.</td>
<td>Carbon Tetrachloride</td>
<td>A</td>
</tr>
<tr>
<td>12.</td>
<td>Chloroform</td>
<td>A</td>
</tr>
<tr>
<td>13.</td>
<td>Chromic Acid, 60%</td>
<td>B</td>
</tr>
<tr>
<td>14.</td>
<td>Cresol</td>
<td>A</td>
</tr>
<tr>
<td>15.</td>
<td>Dichloracetic Acid</td>
<td>A</td>
</tr>
<tr>
<td>16.</td>
<td>Dimethylformamide</td>
<td>A</td>
</tr>
<tr>
<td>17.</td>
<td>Dioxane</td>
<td>A</td>
</tr>
<tr>
<td>18.</td>
<td>Ethyl Ether</td>
<td>A</td>
</tr>
<tr>
<td>19.</td>
<td>Formaldehyde, 37%</td>
<td>A</td>
</tr>
<tr>
<td>20.</td>
<td>Formic Acid, 90%</td>
<td>B</td>
</tr>
<tr>
<td>21.</td>
<td>Furfural</td>
<td>A</td>
</tr>
<tr>
<td>22.</td>
<td>Gasoline</td>
<td>A</td>
</tr>
<tr>
<td>23.</td>
<td>Hydrofluoric Acid, 37%</td>
<td>B</td>
</tr>
<tr>
<td>24.</td>
<td>Hydrofluoric Acid, 48%</td>
<td>B</td>
</tr>
<tr>
<td>25.</td>
<td>Hydrogen Peroxide, 30%</td>
<td>B</td>
</tr>
<tr>
<td>26.</td>
<td>Iodine, Tincture of</td>
<td>B</td>
</tr>
<tr>
<td>27.</td>
<td>Methyl Ethyl Ketone</td>
<td>A</td>
</tr>
<tr>
<td>28.</td>
<td>Methylene Chloride</td>
<td>A</td>
</tr>
<tr>
<td>29.</td>
<td>Monochlorobenzene</td>
<td>A</td>
</tr>
<tr>
<td>30.</td>
<td>Naphthalene</td>
<td>A</td>
</tr>
<tr>
<td>31.</td>
<td>Nitric Acid, 20%</td>
<td>B</td>
</tr>
<tr>
<td>32.</td>
<td>Nitric Acid, 30%</td>
<td>B</td>
</tr>
<tr>
<td>33.</td>
<td>Nitric Acid, 70%</td>
<td>B</td>
</tr>
<tr>
<td>34.</td>
<td>Phenol, 90%</td>
<td>A</td>
</tr>
<tr>
<td>35.</td>
<td>Phosphoric Acid, 85%</td>
<td>B</td>
</tr>
<tr>
<td>36.</td>
<td>Silver Nitrate, Saturated</td>
<td>B</td>
</tr>
<tr>
<td>37.</td>
<td>Sodium Hydroxide, 10%</td>
<td>B</td>
</tr>
<tr>
<td>38.</td>
<td>Sodium Hydroxide, 20%</td>
<td>B</td>
</tr>
<tr>
<td>39.</td>
<td>Sodium Hydroxide, 40%</td>
<td>B</td>
</tr>
<tr>
<td>40.</td>
<td>Sodium Hydroxide Flake</td>
<td>B</td>
</tr>
<tr>
<td>41.</td>
<td>Sodium Sulfide Saturated</td>
<td>B</td>
</tr>
<tr>
<td>42.</td>
<td>Sulfuric Acid, 33%</td>
<td>B</td>
</tr>
<tr>
<td>43.</td>
<td>Sulfuric Acid, 77%</td>
<td>B</td>
</tr>
<tr>
<td>44.</td>
<td>Sulfuric Acid 96%</td>
<td>B</td>
</tr>
<tr>
<td>45.</td>
<td>Sulfuric Acid, 77% &amp; Nitric Acid, 70% equal parts</td>
<td>B</td>
</tr>
<tr>
<td>46.</td>
<td>Toluene</td>
<td>A</td>
</tr>
<tr>
<td>47.</td>
<td>Trichloroethylene</td>
<td>A</td>
</tr>
<tr>
<td>48.</td>
<td>Xylene</td>
<td>A</td>
</tr>
<tr>
<td>49.</td>
<td>Zinc Chloride, Saturated</td>
<td>B</td>
</tr>
</tbody>
</table>

© SEFA - 5th Edition Desk Reference - Version 2.0
Level 0  No detectable change.
Level 1  Slight change in color or gloss.
Level 2  Slight surface etching or severe staining.
Level 3  Pitting, cratering, swelling, or erosion of coating. Obvious and significant deterioration.

Acceptance Level: Results will vary from manufacturer to manufacturer. Corrosion resistant finishes should result in no more than four Level 3 conditions. Suitability for a given application is dependent upon the chemicals used in a given laboratory.

c. Adhesion Test


6.0  Color Coding

The handle of each laboratory fitting (except pressure regulators) shall be marked to indicate the particular liquid or gas that is delivered by or through such fitting. The handle or the index button fastened to the handle shall be color coded, and the index button shall be marked with a symbol to designate the service. Letters used to designate the service or symbol shall be legible and easy to read. Symbols shall be in accordance with the list below:

<table>
<thead>
<tr>
<th>No</th>
<th>Service</th>
<th>Color</th>
<th>Code</th>
<th>Color</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Cold Water</td>
<td>Dark Green</td>
<td>CW</td>
<td>White</td>
</tr>
<tr>
<td>2</td>
<td>Hot Water</td>
<td>Red</td>
<td>RW</td>
<td>White</td>
</tr>
<tr>
<td>3</td>
<td>Steam</td>
<td>Black</td>
<td>STM</td>
<td>White</td>
</tr>
<tr>
<td>4</td>
<td>Air</td>
<td>Orange</td>
<td>Air</td>
<td>Black</td>
</tr>
<tr>
<td>5</td>
<td>Gas</td>
<td>Dust Blue</td>
<td>Gas</td>
<td>White</td>
</tr>
<tr>
<td>6</td>
<td>Vacuum</td>
<td>Yellow</td>
<td>Vac</td>
<td>Black</td>
</tr>
<tr>
<td>7</td>
<td>Distilled Water</td>
<td>White</td>
<td>D/W</td>
<td>Black</td>
</tr>
<tr>
<td>8</td>
<td>Oxygen</td>
<td>Light Green</td>
<td>OKY</td>
<td>White</td>
</tr>
<tr>
<td>9</td>
<td>Hydrogen</td>
<td>Pink</td>
<td>H</td>
<td>Black</td>
</tr>
<tr>
<td>10</td>
<td>Nitrogen</td>
<td>Gray</td>
<td>N</td>
<td>Black</td>
</tr>
<tr>
<td>11</td>
<td>All Other Rare Gases</td>
<td>Light Blue</td>
<td>Chemical Symbol</td>
<td>Black</td>
</tr>
</tbody>
</table>

7.0  General Requirements for Laboratory Service Fittings

7.1  Workmanship

Laboratory service fixtures shall be of superior workmanship. Working parts shall be uniform and shall have smooth, even machining free of burrs, rough edges and ragged threads.

7.2  Handling

Fittings and components shall withstand normal handling and installation without damage or distortion of any part. Where special handling of a fitting is required, appropriate instructions shall either be attached to the fitting or packaged therewith.

7.3  Installation

7.3.1  Fitting Design

Fittings shall be designed to readily facilitate field installation, as follows:

a. All fittings shall be provided with suitable means to connect to a type of supply line in common use in laboratories.

b. The fitting manufacturer shall design its fittings or shall otherwise provide that fittings may be installed and connected without marring the finish or otherwise damaging the fitting or the surface on which it is to be mounted.

c. Deck mounted fittings shall be furnished with mounting shanks with sufficient length to be mounted on counter tops up to 1 1/2 inches thick. The diameter of the base of the fitting, flange or cover plate shall not be less than 1 1/2 inches.

Panel mounted combination hot and cold water faucets shall be furnished with union type inlets for ease of installation. The diameter of the flange or cover plate shall not be less than 1 1/2 inches.

e. Means shall be provided to securely mount the fitting to withstand loading normally encountered in service.
7.3.2  Field Installation

The installer responsible for the installation of laboratory service fittings shall follow good plumbing practice. Installers shall, in particular:

a. Thoroughly clean and flush supply lines prior to installing fittings, as pipe shavings, scale and other debris can be carried through a pipe and into a faucet or valve when the plumbing system is activated. Such foreign matter can damage valve components and interfere with the proper operation of the fitting.

b. Secure the fitting to a counter top or wall using the locknut and lock washer provided by the manufacturer. Tighten the locknut sufficiently to secure the fitting to the counter or wall, but care shall be taken not to over-tighten.

c. Observe the manufacturer’s recommended test and working pressures for fittings. Testing or using a fitting at pressure for which it is not designed can result in leakage or failure.

d. Clean fittings using a soft cloth and soapy water. Use of abrasives, detergents or other cleaners can damage the finish on a fitting. Solvents shall not be used in or near a fitting, as solvents can dissolve lubricants used in the valve mechanism of a fitting.

7.4  Threads and Other Connections

7.4.1  Pipe Threads

a. Taper pipe threads on inlets and field assembled joints shall conform to ASME B1.20.1.

b. Threaded connections having IPS threads shall be tested with a torque wrench to apply torque load specified below without showing evidence of cracking or separation. Distortion or failure of any component part of the assembly shall constitute a failure of the assembly. Torque measurements shall be made with torque wrenches having a maximum allowable inaccuracy of 3% of the full scale reading.

Thread Assembling Torques:

<table>
<thead>
<tr>
<th>Fitting Size (IPS)</th>
<th>Torque, Ft-Lb (N-m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>3/8</td>
<td>32 (43)</td>
</tr>
<tr>
<td>½</td>
<td>45 (61)</td>
</tr>
<tr>
<td>¾</td>
<td>65 (88)</td>
</tr>
<tr>
<td>1</td>
<td>95 (129)</td>
</tr>
</tbody>
</table>

7.4.2  Inlets for Sink Fittings

Shank lengths of deck mounted fittings shall be at least 1 ¾ inches (45 mm).

7.4.3  Solder Connections

The dimensions of solder joint end for connection to copper tube or copper tube fittings, except factory assembled parts, shall conform with respect to length and diameter of the joint section to the dimensions given in ASME B16.18 or ASME B16.22.

7.5  Marking

7.5.1  Product Marking

a. Each fitting shall bear permanent legible markings to identify the manufacturer. This marking shall be the trade name, trademark, or other mark known to identify the manufacturer or in the case of private labeling, the name of the customer or trademark for whom the fitting was manufactured. Such marking shall be located where it can be seen after installation. This marking shall be by means of either a permanent mark or a permanent label on the product.

b. Permanent labels shall comply with the performance requirements of UL 969. Labels shall comply with the requirements for indoor use where exposed to high humidity or occasional exposure to water, and shall have a temperature rating of at least 176 F (80 C).

7.5.2  Packaging

The package shall be marked with the manufacturer’s name and model number, or in the case of private labeling, the name of the customer or trademark for whom the fitting was manufactured.
8.0 Water Faucets and Fittings

8.1 General Requirements

8.1.1 Working Pressures

All faucets and fittings for water service shall be designed to function at water working gauge pressures between 20 PSI (140 kPa) and 125 PSI (860 kPa), and for intermittent shock gauge pressures up to 180 PSI (1,240 kPa).

8.1.2 Working Temperatures

All faucets and fittings for water service shall be designed to function at supply temperatures from 40 F (4C) to 150 F (66 C) and shall withstand 180 F (82 C) for 0.5 hours without failure of the pressure envelope.

8.2 Valve Construction

a. All faucets and fittings for water service shall be designed to have either (i) a renewable unit or cartridge containing all working components subject to wear, or (ii) renewable working components, including seat, seat disc and seals. After installation of the faucet or fitting, all wearing parts shall be capable of being replaced and such replacement shall be able to be accomplished without removing the body from the piping or disconnecting the fitting from the supply pipe or surface on which it is installed.

b. Joints which may have to be taken apart to replace worn parts after the fitting is installed shall be designed so that they may be disassembled and reassembled without damaging or marring a significant surface of the fitting or a significant surface on which the fitting is installed.

c. The seat disc arrangement shall be made so that it will neither vibrate nor loosen in service and so that it can be replaced.

d. Packings shall be of such design and quality as to ensure leak-proof joints and be capable of providing satisfactory field service.

8.3 Goosenecks, Spouts and Outlet Fittings

8.3.1 General Construction

Goosenecks and spouts shall be one of the following types:

a. Rigid Construction. Goosenecks and spouts may be rigid (i.e. non-moveable) type. Rigid goosenecks shall thread directly into the faucet body and shall be constructed so as to be immobile in ordinary use. Rigid goosenecks are typically used at cup sink locations.

b. Swing Construction. Goosenecks and spouts may be swing or swivel type. Swing goosenecks and spouts shall be able to swivel around the faucet body. Swing goosenecks are typically used at laboratory sinks.

c. Rigid/Swing or Convertible Construction. Goosenecks and spouts may be rigid/swing or convertible construction. Goosenecks shall be capable of being either rigid or swing, and may be converted in the field from rigid to swing and vice versa.

8.3.2 Packings

Packings shall be of such design and quality as to ensure leak-proof joints and be capable of providing satisfactory field service.

Swing goosenecks and spouts designed to use an adjustable packing in the joint between the spout and the body shall be constructed so that the adjustments can be made without removing the gooseneck or spout.

8.3.3 Outlets

a. The outlet of all goosenecks and spouts shall have a 3/8 inch NPS or NPT female thread or be so designed as to accommodate an adapter with a 3/8 inch NPS or NPT female thread.

b. All outlet fittings and accessories, such as serrated hose ends, aerators and aspirators, shall have a 3/8 inch NPS or NPT male thread or be so designed as to accommodate an adapter with a 3/8 inch NPS or NPT male thread.
8.4 Testing

8.4.1 Strength Tests

8.4.1.1 Burst Strength Test

Fittings shall withstand a hydrostatic gauge pressure of 500 PSI (3,445 kPa) for two (2) minutes. The pressure shall be applied (i) for one (1) minute to the inlet with the valve(s) closed, and (ii) for one (1) minute to the inlet with the outlet blocked and the valve open. The fitting shall not show any permanent distortion or failure of the pressure envelope.

8.4.1.2 Bending Loads on Fittings

No cross section of a rigid waterway on the pressure side of a faucet or fitting shall be damaged when tested in accordance with the following test. A force shall be applied not closer to the cross-section being tested than twice the major diameter of that section. The bending moment shall be as specified below. This requirement shall not apply to waterways through a solder joint or equivalent.

Bending Loads on Fittings:

<table>
<thead>
<tr>
<th>Nominal Size (In)</th>
<th>Bending Moment, Ft-Lb (N-m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>3/8</td>
<td>30 (40)</td>
</tr>
<tr>
<td>½</td>
<td>44 (60)</td>
</tr>
<tr>
<td>¾</td>
<td>60 (80)</td>
</tr>
<tr>
<td>1</td>
<td>74 (100)</td>
</tr>
</tbody>
</table>

8.4.1.3 Spout Strength Test

Goosenecks and spouts shall withstand a minimum bending moment of 175 in.-lbf (19.7 N-m) at the centerline of the joint between the gooseneck or spout and the body.

The faucet shall be mounted in accordance with the manufacturer’s instructions. The angle of the gooseneck or spout outlet shall be measured from the vertical. Sufficient weight shall be applied to the centerline of the spout outlet to generate a 175 in.-lbf (19.7 N-m) bending moment at the centerline of the spout/body joint for three (3) minutes. One-half (.5) hours after the weight has been removed, the spout outlet angle shall be measured. The faucet shall have failed the test if the angle shall have changed from the angle measured prior to loading.

8.4.2 Handle Security Test

a. The faucet or fitting handle shall be designed so that it fits securely to the valve stem of the fitting, with no lateral movement or play, and it will not be damaged by normal use of the fitting to which it is attached. Except for faucets or fittings that are intended to be vandal-resistant (see below), the faucet or fitting handle shall be secured in such a manner that it can be removed in service using standard tools.

b. The handle shall be tested by loading an applied torque or force in the same manner required to close the valve to an amount of (i) 45 in.-lb (5.1 N-m) for rotary motion (torque), and (ii) 45 lbs (200.25 N) for linear normal motion (force). Failure shall be consist of damage or fracture of the handle or valve stem (including damage or stripping of the splines or broach in the handle).

c. The handle shall not fracture or pull off under an axial static load of 150 lbf (667 N).

8.4.3 Valve Operating Test

When closed, valves shall not leak at any test gauge pressure between 20 PSI (140 kPa) and 200 PSI (1,400 kPa) applied to the inlet for 5 minutes. The torque or force required to open or close a manually activated valve shall not exceed (i) 15 in.-lb (1.7 N-m) for rotary motion (torque), or (ii) 15 lb (66.75 N) for linear normal motion (force). The force shall be applied at the extreme end of the handle. This test shall not apply to self-closing valves or nonmetallic fittings intended for use with purified water (see below).

8.4.4 Life Tests

8.4.4.1 Life Test for Valves

a. Valves shall be subjected to a life test for 500,000 cycles of operation. After completion of the life test, the valve shall control the flow of water at test pressure with an application of force or torque to the lever or handle not to exceed 50% more than the valve force or torque specified in Section 8.2.3 above.
b. The test procedure for valves shall be as follows:

1. The cold water supply shall be at ambient temperature and the hot water supply at 140 F +/- 10 F (60 C +/- 5 C). Both supplies shall be at the same flowing gauge pressure of 50 +/- 5 PSI (350 +/- 35 kPa). Manually operated fittings shall be operated from full off to three-eighths of a turn open, but not to exceed three-fourths of the maximum amount of turning from fully closed to fully open, and back to full off (one cycle) at the rate of 1,500 cycles per hour (minimum). The test apparatus shall apply sufficient load to close the valve throughout the test, but shall in no case exceed 50% greater than the load specified in Section 8.2.3 above.

2. Single control mixing valves shall be cycled alternately from off to full hot and back for 30 cycles, and from off to full cold and back for 30 cycles.

8.4.4.2 Life Test for Goosenecks and Spouts

a. Swing goosenecks and spouts shall be subjected to a life test for 50,000 cycles of operation. The swing gooseneck or spout shall (i) hold a hydrostatic gauge pressure of 125 PSI (860 kPa) for 1 minute after 25,000 cycles with the original seal in place; and (ii) hold a hydrostatic gauge pressure of 125 PSI (860 kPa) for 1 minute after 50,000 cycles. The seal may be replaced to pass once during this test.

b. The test procedure for swing goosenecks and spouts shall be as follows. The fitting shall be mounted on the life test apparatus with the axis about which the spout turns in line with the axis of the drive spindle. The forked end of the drive adapter shall be fitted loosely over the spout; the drive adapter shall be free to move vertically and shall be so weighed that a bending torque of 5 in.-lbf (0.6 N-m) shall be applied at the base of the spout; the apparatus shall be adjusted to turn the spout through a 90 degree arc, 45 degrees to each side of center. The turning mechanism shall be loaded to apply a static torque of 24 in.-lbf (2.7 N-m) to the centerline of the base of the spout. Cycle speed shall be 1,500 cycles per hour, and hot and cold water alternated every 6,000 cycles. Hot and cold water temperatures and pressures are to be as in the valve test.

8.4.5 High Temperature Extreme Test

Faucets and fittings designed for water service shall withstand a water temperature of 180 F (82 C) for 1 hour without failure of the pressure envelope. The fitting shall be connected to a hot water supply of 180 F (82 C). The cold water inlet shall be blocked. A shutoff valve shall be connected to the outlet and the hot water bled through it to maintain 180 F +/- 5F (82 C +/- 3 C) within the fitting for 1 hour at a gauge pressure of 125 PSI (860 kPa). The fitting shall be considered to have failed if it leaks after the test when a gauge pressure of 125 PSI (860 kPa) is applied with the valve in a closed position.

8.4.6 Intermittent Shock Test

a. Faucets and fittings designed for water service shall withstand an intermittent shock gauge pressure to 180 PSI (1,240 kPa) from a simulated apparatus connected to the spout outlet as described below.

b. Water supply to the hot side of the fitting shall be at 140 F +/- 10 F (60 C +/- 5 C) such that the flow gauge pressure is 125 PSI at 2.0 +/-.

c. .24 GPM (860 kPa at 7.6 +/- .95 L/min) with the fitting in the full hot position. The cold side inlet shall be at a gauge pressure of 125 PSI (860 kPa) static and at ambient cold water temperature. A simulated apparatus such as rapid closing solenoid valve shall be connected downstream of the spout so as to create a shock gauge pressure of 180 PSI (1,240 kPa). The solenoid valve shall be cycled at a rate of two seconds open, two seconds closed for a duration of 30,000 cycles.

d. Any leakage shall be cause for rejection under the following conditions: (i) at the end of the test, examine the pressure envelope while still at test pressure; (ii) turn off the valve(s), disconnect the simulated appliance from the spout outlet, and examine with pressure still applied to the inlet.
9.0 Fittings for Natural Gas, Air, Vacuum, Special Gases and Steam Services

9.1 Valve Types, Applications, etc.

9.1.1 Ground Key Cock Valves
Due to the widespread use and acceptance of laboratory ball valves, ground key cock valves are no longer recommended for use in science laboratories.

9.1.2 Laboratory Ball Valves
a. Laboratory ball valves may be used for natural gas, air, vacuum and special gas services. In addition, laboratory ball valves may be used for water service. Where used for oxygen or high purity gases, valves shall be specially cleaned, lubricated and packed. Ball valves provide on/off control of the service, with a limited degree of metering or control of the service.

b. Ball valves operate by means of a spherical “ball” that is positioned between two seals that are within a body housing and press against the ball to form a watertight or gastight seal. Rotation of the ball 90 degrees opens and closes the valve. Valves have either a lever-type handle or a handle that locks in the closed position and must be lifted to open the valve. In either case, the valve handle shall visually indicate whether the valve is open or closed.

c. Ball valves shall be designed for a working pressure of at least 75 PSI.

9.1.3 Needle Valves
Needle valves may be used for control of all laboratory gases. Where used for oxygen and high purity gases, valves shall be specially cleaned, lubricated and packed. Needle valves shall not be used for water or steam services. Needle valves provide good metering of the service.

a. Needle valves shall have needle point internal construction and a replaceable seat.

b. Needle valves shall have a rated working pressure of at least 145 PSI.

9.1.4 Steam Valves
a. Valves for steam service shall be similar in construction to needle valves, except that valves shall have a renewable valve disc and replaceable seat.

b. Steam valves shall have a rated working pressure of at least 15 PSI steam pressure at 260° F maximum.

9.2 Valves for Burning Gases

9.2.1 Valve Construction
Valves for use with burning gases shall be ground key cock valves, ball valves, needle valves, push/tturn valves or other valve type specifically designed for use with burning gas.

9.2.2 Certification
Valves for burning gas shall be certified to comply with ANSI Z21.15/Canadian Gas Association Standard CGA 9.1, “Manually Operated Gas Valves for Appliances, Appliance Connector Valves and Hose End Valves.”

9.3 Mounting Fittings
Valves for laboratory gases shall be pipe mounted or installed on a horizontal or vertical surface using a mounting fitting. Such fitting may be a turret base, panel flange, wye fitting, etc. Where required, the manufacturer shall furnish a mounting shank with a locknut and lock washer for installation. Unless field installation conditions dictate otherwise, the fitting manufacturer shall install the valve into the mounting fitting and the mounting shank into the mounting fitting, and shall test the assembly as a single, complete unit prior to shipment.

9.4 Valves and Pressure Regulators for High Purity Gases

9.4.1 General
a. Valves and pressure regulators for use on high purity gas distribution systems shall be specially designed and manufactured for such use.
b. Valves and pressure regulators shall not contain any components manufactured from materials that will off-gas contaminants into the high purity gas stream.

c. Where a pressure regulator is installed, there shall be an internal filter, located either inside the pressure regulator or upstream of the pressure regulator, to prevent particles from contacting the seat.

d. All interior surfaces of the valve or pressure regulator that will be in contact with the high purity gas stream shall be ultrasonically cleaned using cleaning agents that will not negatively affect the purity or the gas.

e. Valves and pressure regulators shall be protected during transport and storage against damage and against contamination from particles, moisture, solvents and other foreign matter that could negatively affect the purity of the gas.

9.4.2 Valves and Pressure Regulators for 5.0 Gases

a. Pressure regulators for use with 5.0 gases shall have a metal diaphragm or bellows internal construction.

b. Valves and pressure regulators shall have a maximum leak rate through the valve or regulator of (i) less than 1 x 10^-5 standard cubic centimetres per minute (SCCM) of helium with an outboard leakage test, and (ii) less than 1 x 10^-5 SCCM of helium with an inboard leakage test. The manufacturer of the valve and pressure regulator shall certify the above leak rates.

9.4.3 Valves and Pressure Regulators for 6.0 Gases

Valves and pressure regulators for use with 6.0 gases shall have a metal diaphragm or bellows internal construction. Ball valves, gate valves and other types of valves that have valve stem packings are not suitable for use with 6.0 gases.

Valves and pressure regulators shall have a maximum leak rate through the valve or regulator of (i) less than 1 x 10^-6 standard cubic centimetres per minute (SCCM) of helium with an outboard leakage test, and (ii) less than 1 x 10^-7 SCCM of helium to the atmosphere with an inboard leakage test. The manufacturer of the valve and pressure regulator shall certify the above leak rates.

10.0 Valves and Outlets for Use in Fume Hoods

Fittings for use in fume hoods consist of two primary components: (i) a remote control valve installed outside of the interior fume hood working area or chamber, and (ii) an outlet fitting installed within the fume hood chamber. The valve is controlled by a handle located outside of the fume hood chamber. The outlet fitting is connected to the valve (either directly or by a supply line from the valve), and the service or media is delivered through the outlet fitting within the fume hood chamber.

10.1 Valve Types

Remote control valves for use in fume hoods may be either rod-type or panel mounted, as follows:

10.1.1 Rod-Type Valves

Rod-type valves are installed either within the side wall or underneath the horizontal work surface of the fume hood. Valves may be either straight or angle pattern. Valves are fitted with an extension rod connected to the valve stem that projects through the front face or apron of the fume hood, and a handle is installed on the exposed end of the rod.

10.1.2 Panel Mounted Valves

Panel mounted valves are installed on either the side wall or front apron of the hood. The valve body is mounted on the panel using a locking ring or other locking mechanism. The valve is mounted so that all of the working components of the valve are accessible from the front exterior face of the hood, without accessing the internal side wall of the hood or disturbing the plumbing connections to the valve. Panel mounted valves offer two advantages over rod-type valves:
(i) All of the working components of a panel mounted valve are accessible from the front exterior face of the fume hood. Maintenance of the valve is facilitated, since the fume hood does not have to be entered or disassembled to gain access to the working components of the valve.

(ii) The extension rod used on rod-type valves may tend to twist as the valve is opened and closed. By eliminating the extension rod, panel mounted valves offer the user more precise control of the valve and thus a better ability to meter the flow through the valve.

10.2 Valve Construction

Valves for fume hood use shall have the construction set forth below:

a. Valves for water shall be similar in construction and performance to those described in Section 8 above.

b. Valves for non-burning laboratory gases shall be either ball or needle type and shall have the construction and performance described in Section 9 above.

c. Valves for burning gases shall be either ball type, needle type or push/turn type and shall have the construction and performance described in Section 9 above.

d. Valves for steam shall have the construction and performance described in Section 9 above.

10.3 Outlet Fittings

10.3.1 General Construction

Outlet fittings convey the media from the remote control valve to the interior of the fume hood chamber. They are generally mounted to the side wall or work surface of the fume hood utilizing a mounting shank with locknut and washer. Outlet fittings are available in a variety of configurations including turrets, flanges and goosenecks.

10.3.2 Corrosion Resistance

The outlet fitting installed inside the fume hood chamber will be exposed to the fumes that are generated within the hood. Accordingly, these fittings should be resistant to corrosion, either by (i) utilizing a corrosion resistant material for the outlet fitting that is suitable for the intended application, or (ii) supplying the fitting with a corrosion resistant finish in accordance with Section 5.2.3 above.

10.3.3 Color Coding

The outlet fitting should be color-coded to designate the service or media delivered through the fitting. Identification can be accomplished a (i) color coding the corrosion resistant coating to match the service index color, or (ii) providing a color-coded index ring or plate. The color-coding shall match the corresponding remote control valve handle or index.

10.4 Vacuum Breakers for Use on Fume Hoods

Valves and outlet fittings for potable water service shall be equipped with vacuum breakers to prevent backflow or back-siphonage into the potable water system. Vacuum breakers shall meet the provisions of Section below. Vacuum breakers shall be installed (i) in accordance with the manufacturer’s instructions and applicable plumbing codes, and (ii) in a location where they are accessible for maintenance.

10.5 Installation

Unless field conditions otherwise require, remote control valves and outlet fittings shall be installed, plumbed and pressure tested prior to shipment of the fume hood from the manufacturer’s factory.

11.0 Faucets for Purified Water

11.1 General

Many laboratory processes and procedures require the availability and use of purified water. Purified water is domestic water that has been treated to reduce the concentration of impurities in it. Impurities may take the form of organic or inorganic substances, live bacteria and/or dissolved gases. Purity requirements vary depending upon the final use of the water.
However, purified water may be categorized as follows:

Laboratory Grade: water from which one or more categories of contaminants have been removed.

Reagent Grade: water from which all categories of contaminants have been removed, with subclassifications Type IV through Type I indicating increasing quality.

Water purity is further measured in terms of resistance to electrical current. A value of 18.3 megohms-centimeter at 25 degrees C is the maximum achievable value of electrical resistivity.

Several processes to purify water are commonly used, including distillation, reverse osmosis (RO) and deionization (DI). The choice of process depends on a wide variety of factors, including the type of experimentation or research to be done in the laboratory, the type of purified water required, whether the purified water system is centralized or decentralized, and cost.

11.2 Fitting Materials and Construction

It is generally accepted that the system for treating and distributing purified water is more important to the purity of the delivered water than are the faucets or other fittings installed at the termination points of the system. However, in determining the most suitable type of fitting for dispensing purified water, care should be taken in the selection of the material and construction of the fitting. The materials and construction of fittings for purified water vary widely in the marketplace but, in general, may be divided into three categories:

a. Metallic Fittings. Faucets and fittings may have metallic construction. As such, all metal components that have contact with the purified water (such as the fitting body, gooseneck or spout and internal operating components) shall be (i) brass with an interior lining of an inert metal (such as tin), or (ii) stainless steel. All nonmetallic components (such as valve discs, seals, etc.) shall be compatible with the purified water delivered by the fitting. Metallic fittings shall have the construction and performance set forth in Section 8 above.

b. Nonmetallic Fittings. Faucets and fittings may have nonmetallic construction. As such, all nonmetallic components that have contact with the purified water (such as the fitting body, gooseneck or spout and internal operating components) shall be constructed of an inert plastic, such as PVC, non-pigmented polypropylene, polyvinylidene fluoride (PVDF) or polyethylene. All other components shall be compatible with the purified water delivered by the fitting.

c. Fittings with a Metallic Exterior and Nonmetallic Interior. Faucets and fittings may have an exterior metallic casing with an interior lining of inert plastic. All components that have contact with the purified water shall be nonmetallic and shall be compatible with the purified water delivered by the fitting.

Fittings and faucets may be supplied with manual (compression) control, self-closing control or combination manual/self-closing control. Faucets may be supplied incorporating a method of recirculating the pure water through the interior of the faucet. The recirculation shall permit the water to circulate completely to the valve mechanism, thus effectively removing any "dead leg”

12.0 Backflow Prevention

12.1 General

All laboratory fittings that deliver potable water shall be equipped with a backflow prevention device. Such device shall be either (i) an atmospheric vacuum breaker, or (ii) a laboratory faucet vacuum breaker. Atmospheric vacuum breakers shall be certified to comply with ANSI/ASSE Standard 1001, “Pipe Applied Atmospheric Type Vacuum Breakers.” Laboratory faucet vacuum breakers shall be certified to comply with ANSI/ASSE Standard 1035, “Laboratory Faucet Vacuum Breakers.”
13.0 Fittings for ADA Compliance

Pursuant to the requirements of Section 309.4 of ANSI/ICC A117.1, where a faucet or fitting will be used in an application that is intended to be ADA compliant, the maximum force required to open or close a manually activated fitting shall not exceed 5 lb. (22 N) at 80 PSI (550 kPa) static pressure.

14.0 Vandal-Resistant Fittings

Laboratory fittings are frequently installed in facilities such as high schools, junior colleges and other public facilities where they might be subject to vandalism and physical abuse. In such facilities, consideration should be given to installing service fixtures and fittings that are vandal-resistant. Vandal-resistant service fixtures shall be designed to meet the following criteria:

14.1 Resistance to Physical Abuse

Each fitting shall, so far as possible, resist turning, bending, breakage and unintended disassembly through acts of vandalism or physical abuse. Construction features shall include:

a. All threaded connections that will not require field service (including the connection between a valve and mounting fitting, and between a mounting fitting and mounting shank) shall be secured with a suitable adhesive so as to be non-removable.

b. Goosenecks and spouts shall be constructed of heavy duty pipe or tubing that is sufficient to resist bending and breakage.

c. Faucet bodies, turret bases and other mounting fittings shall be provided with locking pins or other means to prevent the fixture from being turned on the work surface, panel or wall surface.

d. Outlet fittings (such as serrated hose ends and aerators) shall either be of vandal-resistant design or shall be secured in place with an adhesive.

e. Index buttons shall be tamperproof.

14.2 Protection of Supply Lines

Each fitting shall be designed to protect against contaminants from entering the service lines by means of backflow, back-siphonage, or acts of vandalism. Accordingly, water fittings shall be furnished with vacuum breakers to prevent contamination of the potable water system through backflow or back-siphonage. Valves for laboratory gases shall be furnished with internal check valves to prevent backflow through the valve.

14.3 Maintenance

Vandal-resistant fixtures shall be designed to provide maintenance personnel with access to internal components for service requirements. Construction features shall include, but are not limited to:

Valve packing nuts shall be secured with set screws.

Vacuum breaker covers shall be secured with vandal-resistant screws that may be removed only by maintenance personnel.

15.0 Electrical Fittings

Electrical pedestal boxes may be provided on laboratory work surfaces for the installation of power and data devices and outlets. Electric pedestal boxes shall have a cast aluminum housing and shall be supplied with a mounting shank and locknut for installation on the countertop or work surface. Pedestal boxes shall have a satin (brushed) finish, polished finish or shall have a corrosion resistant coating in conformance with Section 5.2.3 above. Pedestal boxes shall be certified to comply with the provisions of ANSI/UL 514A, “Standard for Metallic Outlet Boxes.”

16.0 Emergency Eye Wash and Shower Equipment

16.1 General Requirements

Emergency eye wash and shower equipment

© SEFA - 5th Edition Desk Reference - Version 2.0
installed in laboratory facilities shall comply with the provisions of ANSI Z358.1, “Emergency Eye Wash and shower Equipment.”

16.2 Materials and Finishes

Where emergency eye wash and shower equipment is installed within the workspace of a laboratory room, the metal components used in the equipment shall be (i) brass, with either a chrome plated or corrosion resistant finish, (ii) stainless steel, or (iii) galvanized steel with a corrosion resistant finish. Where emergency equipment is installed on or immediately adjacent to a laboratory work surface or countertop, the metal components used in the equipment shall be (i) brass, with either a chrome plated or corrosion resistant finish, or (ii) stainless steel. Chrome plated and corrosion resistant finishes shall conform to the provisions of Section 5 above.

Appendix

Protection of Potable Water Systems

In recent years, there has been a great deal of concern and discussion regarding the effects of contamination of drinking water on human health. As a result of these concerns, the American National Standards Institute (ANSI) and NSF International have adopted ANSI/NSF International Standard 61, Section 9, “Drinking Water System Components – Health Effects.” This standard was promulgated to establish minimum requirements for the control of potential adverse human health effects from products which contact drinking water. This standard covers mechanical plumbing devices, components and materials that are typically installed at the endpoint of a water distribution system and are intended by the manufacturer to dispense water for human ingestion. In order to comply with this standard, many manufacturers of plumbing products have changed the materials used in their products, including reducing or removing lead from the brass alloys used for their products.

As noted above, ANSI/NSF 61, Section 9 applies only to products that are intended to dispense water for human consumption. The standard specifically exempts “all commercial, industrial, and institutional devices that are not (otherwise) included, including …laboratory fittings.” (emphasis added) This standard thus specifically exempts laboratory faucets and fittings.

It is the position of SEFA that laboratory fittings are not designed, manufactured, sold or installed for the purpose of delivering water for human ingestion. SEFA endorses the position of ANSI and NSF International that the provisions of ANSI/NSF 61 do not apply to laboratory faucets and fittings. Moreover, ingesting water in a laboratory raises serious safety issues beyond exposure to the contaminants that might be found in drinking water, regardless of their origin. Safe laboratory work practices should always prohibit laboratory users from eating or drinking in a laboratory work environment.
# Table Of Contents

<table>
<thead>
<tr>
<th>Chapter</th>
<th>Pages</th>
<th>Sections</th>
</tr>
</thead>
<tbody>
<tr>
<td>Committee Members</td>
<td>181</td>
<td>5.2 Door Impact Test</td>
</tr>
<tr>
<td>Foreword</td>
<td>182</td>
<td>5.2.1 Purpose of Test</td>
</tr>
<tr>
<td>Sections</td>
<td></td>
<td>5.2.2 Test Procedure</td>
</tr>
<tr>
<td>1.0 Scope</td>
<td>183</td>
<td>5.2.3 Acceptance Level</td>
</tr>
<tr>
<td>2.0 Purpose</td>
<td>183</td>
<td>5.3 Door Cycle Test</td>
</tr>
<tr>
<td>3.0 Definitions</td>
<td>183</td>
<td>5.3.1 Purpose of Test</td>
</tr>
<tr>
<td>3.1 Description of Testing Apparatus</td>
<td></td>
<td>5.3.2 Test Procedure</td>
</tr>
<tr>
<td>4.0 Base Cabinets</td>
<td>186</td>
<td>5.3.3 Acceptance Level</td>
</tr>
<tr>
<td>4.1 Description of Test Unit</td>
<td></td>
<td>6.0 Drawers</td>
</tr>
<tr>
<td>4.2 Cabinet Load Test</td>
<td></td>
<td>6.1 Drawer Static Test</td>
</tr>
<tr>
<td>4.2.1 Purpose of Test</td>
<td></td>
<td>6.1.1 Purpose of Test</td>
</tr>
<tr>
<td>4.2.2 Test Procedure</td>
<td></td>
<td>6.1.2 Test Procedure</td>
</tr>
<tr>
<td>4.2.3 Acceptance Level</td>
<td></td>
<td>6.1.3 Acceptance Level</td>
</tr>
<tr>
<td>4.3 Cabinet Concentrated Load Test</td>
<td></td>
<td>6.2 Drawer and Door Pull Test</td>
</tr>
<tr>
<td>4.3.1 Purpose of Test</td>
<td></td>
<td>6.2.1 Purpose of Test</td>
</tr>
<tr>
<td>4.3.2 Test Procedure</td>
<td></td>
<td>6.2.2 Test Procedure</td>
</tr>
<tr>
<td>4.3.3 Acceptance Level</td>
<td></td>
<td>6.2.3 Acceptance Level</td>
</tr>
<tr>
<td>4.4 Cabinet Torsion</td>
<td></td>
<td>6.3 Drawer Impact Test</td>
</tr>
<tr>
<td>4.4.1 Purpose of Test</td>
<td></td>
<td>6.3.1 Purpose of Test</td>
</tr>
<tr>
<td>4.4.2 Test Procedure</td>
<td></td>
<td>6.3.2 Test Procedure</td>
</tr>
<tr>
<td>4.4.3 Acceptance Level</td>
<td></td>
<td>6.3.3 Acceptance Level</td>
</tr>
<tr>
<td>4.5 Cabinet Submersion Test</td>
<td></td>
<td>6.4 Drawer Internal Impact Test</td>
</tr>
<tr>
<td>Not applicable to Metal Casework</td>
<td></td>
<td>6.4.1 Purpose of Test</td>
</tr>
<tr>
<td>4.6 Spill Containment Test</td>
<td></td>
<td>6.4.2 Test Procedure</td>
</tr>
<tr>
<td>Not applicable to Metal Casework</td>
<td></td>
<td>6.4.3 Acceptance Level</td>
</tr>
<tr>
<td>5.0 Doors</td>
<td>188</td>
<td>6.5 Drawer Cycle Test</td>
</tr>
<tr>
<td>5.1 Door Hinge Test</td>
<td></td>
<td>6.5.1 Purpose of Test</td>
</tr>
<tr>
<td>5.1.1 Purpose of Test</td>
<td></td>
<td>6.5.2 Test Procedure</td>
</tr>
<tr>
<td>5.1.2 Test Procedure</td>
<td></td>
<td>6.5.3 Acceptance Level</td>
</tr>
<tr>
<td>5.1.3 Acceptance Level</td>
<td></td>
<td>7.0 Shelving</td>
</tr>
<tr>
<td>5.2 Door Impact Test</td>
<td></td>
<td>7.1 Description of Test Unit</td>
</tr>
<tr>
<td>5.2.1 Purpose of Test</td>
<td></td>
<td>7.2 Shelf Load Test</td>
</tr>
<tr>
<td>5.2.2 Test Procedure</td>
<td></td>
<td>7.2.1 Purpose of Test</td>
</tr>
<tr>
<td>5.2.3 Acceptance Level</td>
<td></td>
<td>7.2.2 Test Procedure</td>
</tr>
<tr>
<td>7.0 Shelving</td>
<td>191</td>
<td>7.2.3 Acceptance Level</td>
</tr>
</tbody>
</table>
### 8.0 Cabinet Surface Finish Tests

- **8.1 Chemical Spot Test**
  - 8.1.1 Purpose of Test
  - 8.1.2 Test Procedure
  - 8.1.3 Acceptance Level

- **8.2 Hot Water Test**
  - 8.2.1 Purpose of Test
  - 8.2.2 Test Procedure
  - 8.2.3 Acceptance Level

- **8.3 Impact Test**
  - 8.3.1 Purpose of Test
  - 8.3.2 Test Procedure
  - 8.3.3 Acceptance Level

- **8.4 Paint Adhesion Test**
  - 8.4.1 Purpose of Test
  - 8.4.2 Test Procedure
  - 8.4.3 Acceptance Level

- **8.5 Paint Hardness Test**
  - 8.5.1 Purpose of Test
  - 8.5.2 Test Procedure
  - 8.5.3 Acceptance Level

- **8.6 Dart Impact Test**
  - Not applicable to Metal Casework

- **8.7 Edge Delaminating Test**
  - Not applicable to Metal Casework

- **8.8 Edge Impact Test**
  - Not applicable to Metal Casework

- **8.9 Wear Resistance (Abrasion) Test**
  - Not applicable to Metal Casework

### 9.0 Wall Cabinets, Counter Mounted and Tall Units

- **9.1 Description of Test Unit**

- **9.2 Load Test**
  - 9.2.1 Purpose of Test
  - 9.2.2 Test Procedure
  - 9.2.3 Acceptance Level

### 10.0 Tables

- **10.1 Description of Test Unit**

- **10.2 Load Test**
  - 10.2.1 Purpose of Test
  - 10.2.2 Test Procedure
  - 10.2.3 Acceptance Level

- **10.3 Table Racking Test**
  - 10.3.1 Purpose of Test
  - 10.3.2 Test Procedure
  - 10.3.3 Acceptance Level

### Endnotes

### Forms

---

Table Of Contents (cont’d.)

<table>
<thead>
<tr>
<th>8.0 Cabinet Surface Finish Tests</th>
<th>192</th>
</tr>
</thead>
<tbody>
<tr>
<td>8.1 Chemical Spot Test</td>
<td></td>
</tr>
<tr>
<td>8.2 Hot Water Test</td>
<td></td>
</tr>
<tr>
<td>8.3 Impact Test</td>
<td></td>
</tr>
<tr>
<td>8.4 Paint Adhesion Test</td>
<td></td>
</tr>
<tr>
<td>8.5 Paint Hardness Test</td>
<td></td>
</tr>
<tr>
<td>8.6 Dart Impact Test</td>
<td></td>
</tr>
<tr>
<td>8.7 Edge Delaminating Test</td>
<td></td>
</tr>
<tr>
<td>8.8 Edge Impact Test</td>
<td></td>
</tr>
<tr>
<td>8.9 Wear Resistance (Abrasion) Test</td>
<td></td>
</tr>
<tr>
<td>9.0 Wall Cabinets, Counter Mounted and Tall Units</td>
<td>195</td>
</tr>
<tr>
<td>9.1 Description of Test Unit</td>
<td></td>
</tr>
<tr>
<td>9.2 Load Test</td>
<td></td>
</tr>
<tr>
<td>10.0 Tables</td>
<td>195</td>
</tr>
<tr>
<td>10.1 Description of Test Unit</td>
<td></td>
</tr>
<tr>
<td>10.2 Load Test</td>
<td></td>
</tr>
<tr>
<td>10.3 Table Racking Test</td>
<td></td>
</tr>
<tr>
<td>Endnotes</td>
<td>197</td>
</tr>
<tr>
<td>Forms</td>
<td>198</td>
</tr>
</tbody>
</table>
SEFA 8-M Committee Members

Committee Chair
Richard Johnson - ICI Scientific

Air Master Systems
Bedcolab
Eagle MHC
HEMCO Corporation
Kewaunee Scientific Corporation
Lab Crafters, Inc.
Mott Manufacturing, Ltd.,
Foreword

SEFA Profile

The Scientific Equipment and Furniture Association (SEFA) is an international trade association comprised of manufacturers of laboratory furniture, casework, fume hoods and members of the design and installation professions. The Association was founded to promote this rapidly expanding industry and improve the quality, safety and timely completion of laboratory facilities in accordance with customer requirements.

SEFA Recommended Practices

SEFA and its committees are active in the development and promotion of Recommended Practices having domestic and international applications. Recommended Practices are developed by the association taking into account the work of other standard writing organizations. Liaison is also maintained with government agencies in the development of their specifications.

SEFA's Recommended Practices are developed in and for the public interest. These practices are designed to promote a better understanding between designers, architects, manufacturers, purchasers, and end-users and to assist the purchaser in selecting and specifying the proper product to meet the user's particular needs. SEFA's Recommended Practices are periodically updated. The Recommended Practices are numbered to include an annual suffix which reflects the year that they were updated. SEFA encourages architects to specify these Recommended Practices as follows: “SEFA 8M-2016”.

SEFA Glossary of Terms

SEFA has developed a Glossary of Terms (SEFA 4-2010) for the purpose of promoting a greater understanding between designers, architects, manufacturers, purchasers and end users. The terms defined by SEFA are frequently used in contracts and other documents, which attempt to define the products to be furnished or the work involved. The Association has approved this Glossary in an effort to provide uniformity among those who use these terms. Where a specific Recommended Practice contains definitions which differ from those in the Glossary of Terms, then the definitions in the specific Recommended Practice should be used.

SEFA encourages all interested parties to submit additional terms or to suggest any changes to those terms already defined by the Association. The definitions should be used to help resolve any disputes that may arise or to incorporate the applicable terms in any contract or related documents.

SEFA Disclaimer

SEFA uses its best effort to promulgate Recommended Practices for the benefit of the public in light of available information and accepted industry practices. SEFA does not guarantee, certify or assure the safety or performance of any products, components, or systems tested, installed, or operated in accordance with SEFA Recommended Practices or that any tests conducted under its Recommended Practices will be non-hazardous or free from risk. SEFA encourages the use of third party independent testing where appropriate.

Note: Testing as described in this document must be performed and documented by a SEFA-approved third party testing facility. See Page 34 of the SEFA Desk Reference 5th Edition Version 2.0, or visit us at SEFALABS.COM for the most current list of SEFA-approved test labs.
1.0  Scope

The scope of this document is intended to provide manufacturers, specifiers, and users tools for evaluating the safety, durability, and structural integrity of metal laboratory grade furniture and complimentary items. This document is inclusive of casework (base units, wall mounted units, counter mounted units, tall units, tables and, shelving systems). Casework and shelving manufactured for laboratory use should be subjected to the tests and procedures outlined below.

Metal laboratory grade casework shall consist of base cabinets, wall cabinets, counter mounted cabinets, tall cabinets, and shelving.

Aggregate test results may vary by manufacturer. Procedures for testing performance criteria shall be as outlined in this document and results made available upon request. It is assumed that the test model reflects the performance criteria for all products. However there may be certain door/drawer configurations and/or sizes outside the test unit configuration identified that may not meet certain parts of this test. A test unit has been identified in this document with the sole purpose of obtaining continuity of procedures and results in a scientific format.

Great care should be exercised when heavy loads are applied to the cabinet and appropriate safety precautions taken to insure safety of testing personnel. Properly trained personnel should perform all tests. SEFA assumes no liability for damage or injury as a result of conducting these tests.

The acceptance levels are based on the cumulative field experience and laboratory testing of SEFA members based on actual needs of laboratories. This is a performance- based document. Specifications proscribing specific materials, hardware, finishes, workmanship or construction may or may not meet acceptance levels of this document. If proscriptive components of the specifications conflict with compliance of this document then the Architectural proscribed elements take precedent.

2.0  Purpose

The purpose of this document is to describe the distinguishing performance characteristics of metal laboratory grade furniture and complimentary items. Furniture shall be of a type specifically designed and manufactured for installation and use in a laboratory.

Although aggregate test results may vary from manufacturer to manufacturer, procedures for testing performance criteria shall be as outlined in this document and results made available upon request. It is assumed that the test model reflects the performance criteria for all products regardless of construction, size, or style used. A test unit has been identified in this document with the sole purpose of obtaining continuity for procedures and results in a scientific format.

3.0  Definitions

Acceptance Levels - The acceptance level for each performance criteria is based on the cumulative experience of actual field testing and laboratory results of SEFA members. Acceptance levels describe the expected outcome of each test procedure.

ANSI/BIFMA - ANSI is the American National Standards Institute. Approval of an American National Standard requires verification by ANSI that the requirements for due process, consensus, and other criteria for approval have been met by the standards developer. BIFMA is the Business and Institutional Furniture Manufacturer's Association, an association of manufacturers of desk products and the like.

Apparatus - A machine or group of machines and accessories.

Arithmetic Mean - A number obtained by dividing the sum of a set of quantities by the number of quantities in a set; average.

**Base Cabinets** - A base cabinet is a storage device consisting of two ends, a back, a face and may or may not include a top or top frame. The face may be open, to access the storage area, or may be outfitted with one or more drawers and/or doors. A base cabinet is always placed on the floor and normally supports a surface. The top surface is normally no more than 42” (1,067mm) off the floor surface.

**Best Practices** - When given a choice of grade, the “best practice” is to select one that offers a well defined degree of control over the quality of workmanship, materials, and installation of a project. SEFA-8 Recommended Practices are written from a view of high quality laboratory furniture.

**Cabinet Depth (Deep)** - Given a front, bottom, two sides, and a top, the cabinet depth is a measure of the side of the cabinet, in its normal upright position, from the outside back to the outside front excluding doors and door fronts.

**Cabinet Height (High)** - Given a front, bottom, two sides, and a top, the cabinet height is a measure of the side of the cabinet, in its normal upright position, from the bottom edge of the side to the top, excluding any surface.

**Cabinet Width (Wide)** - Given a front, bottom, two sides, and a top, the cabinet width is a measure of the front of the cabinet in its normal upright position from one side to the other.

**Casework** - Base and wall cabinets, display fixtures, and storage shelves. The generic term for both “boxes” and special desks, reception counters, nurses stations and the like. Generally includes the tops and work surfaces.

**Chase (Plumbing Area)** - Space located behind the back of the base cabinet used to house plumbing or electric lines.

**Combination Unit** - A base unit of the type that has both door(s) and drawer(s).

**Counter Mounted Cabinet** - A counter mounted cabinet is a wall cabinet (usually with a height of approximately 48”[1,219mm] and is typically mounted on the work surface or shelf, as in a reagent shelf).

**Cupboard (Door Unit)** - That portion of the cabinet with no drawer(s) that may be enclosed by doors.

**Drawer** - A sliding storage box or receptacle opened by pulling out and closed by pushing in.

**Free Standing** - Requiring no support or fastening to other structures.

**Hardware** - Items such as screws, pulls, hinges, latches, locks, and drawer slides used in the construction of casework.

**High Density Shielding** - A barrier made of lead.

**Joinery** – The junction of two pieces intended to be permanently connected.

**Laboratory Furniture** - Furniture designed and manufactured for installation and use in a laboratory.

**Latch** - A piece of hardware designed to hold a door closed.

**Leveling Screws (Levelers)** - Threaded components designed to allow adjustment of the cabinet vertically as needed for leveling.

**Nominal Dimensions** - Not all cabinet manufacturers produce product to the identical dimensions. All dimensions given in this document are accurate to within five percent, which is considered nominal.

**Permanent Damage** - Destruction to material or joinery that would require repair in order to return to its original state.

**Permanent Deformation** - Deflection that has exceeded the limits of the product, thus changing the original shape of the product.
**Permanent Deterioration** - Erosion or corrosion of material such that the component will never return to its original shape.

**Permanent Failure** - See “permanent damage.”

**Pulls** - Articles of hardware used to grasp and open/close the door or drawer (see also hardware).

**Rack Resistance** - The ability of a product to resist stresses that tend to make the product distort and the drawers to become misaligned.

**Rail** - A horizontal member extending from one side of the cabinet to the other.

**Reagent** - A substance used because of its chemical or biological activity.

**Removable Back** - A panel located on the inside back of the base cabinet, which is removable in order to gain access to utilities.

**Stainless Steel** - Iron based alloys containing more chromium than the 12% necessary to produce passivity (less reactive), but less than 30%.

**Submersion** - Covered with water.

**Tables** - An article of furniture having a flat, horizontal surface supported by one or more support members (legs), and a frame (apron).

**Tall Cabinet (Full Height Unit)** - A tall cabinet is a storage device that consists of two ends, a top and bottom panel, a back and a face. The face may be open to access the storage area or may be outfitted with one or more drawers and/or door(s). A tall cabinet is always placed on the floor and is nominally 84" (2,134mm) high.

**Torsion** – A force acting at a distance which tends to twist or rotate an object or cabinet.

**Uniformly Distributed** – A force applied evenly over the area of a surface.

**Unobstructed Entry** - A cabinet is deemed to be unobstructed if access to the entire storage area is completely without obstacle.

**Upright Position** - A cabinet oriented in its intended position.

**Wall Cabinet** - A wall cabinet is a storage device consisting of two ends, a back, a top, bottom, and a face. The face may be open to access the storage area or may be outfitted with one or more door(s). The wall cabinet usually does not include a drawer. A wall cabinet is always mounted on a vertical surface such as a wall, a divider, panel or some other vertical structure. A wall cabinet is usually less than 48" (1,219mm) high.

**Work Surface** - A normally horizontal surface used to support apparatus at a convenient height above the floor. Work surfaces are normally positioned atop a base cabinet or table structure.

### 3.1 Description of Testing Apparatus

**Solid Steel Bar** - A square solid steel bar 2 1/2" (63mm) square, 28 1/4" (717mm) long, weighing 50 pounds (22.679 Kg).

**Sand or Shot Bag (10 pounds [4.545 Kg])** - A bag of plastic or cloth with the approximate dimensions 10 9/16" (268mm) x 11" (279mm) as in typical “gallon size re-closable stor-age bags.” Filled with enough sand or shot so that contents weigh 10 pounds (4.545 Kg).

**Sand Bag (20 pounds [9.071 Kg])** - Two 10 pound (4.545 Kg) sand bags bound together.

**Shot Bag (100 lbs. [45.359 Kg])** - A plastic or cloth bag of sufficient size to contain 100 pounds (45.359 Kg) of shot.

**Cycling Mechanism** - Per ANSI BHMA 156.9.-2003

**Steel Rod** - A 2" (51mm) diameter by 12" (305mm) long rod, approximately 10 pounds (4.535 Kg) in weight.

**Hot Water** - To be considered “hot water,” the temperature of the water must be between 190º F to 205º F (88º C to 96º C).

**One Pound Ball** - Solid steel sphere approximately 2" (51mm) in diameter.
4.0  Base Cabinets

4.1  Description of Test Cabinet

The base cabinet shall be a combination of cupboard and drawer per Figure 1. The base cabinet shall have nominal dimensions ±1" (25.4mm) of 48" (1,219.2mm) wide, 35" (889.0mm) high, and 22" (558.8mm) deep. The drawer shall be above the cupboard, full width and approximately one-fourth the height of the cabinet's face opening. The inside depth of the drawer shall be no less than 18" (457.2mm). The drawer in the full open position shall expose no less than 2/3 of the drawer interior. Cupboard shall be double-door design and provide unobstructed entry into the cabinet interior with the doors open. The unit shall contain one adjustable shelf. The cabinet back shall be the removable type (per manufactures standard design as used for access to the plumbing or chase area) with the removable panel removed.

The cabinet shall be free standing, squared and leveled and sitting 1" (25.4mm) off the floor on all four leveling screws. When leveling screws are not required, the cabinet shall be squared and leveled and sitting 1" (25.4mm) off the floor atop four hardwood corner blocks 2" (50.8mm) square and 1" (25.4mm) high. A top of 1" (25.4mm) thick 37-50 pcf medium density fiberboard shall be freely positioned on the cabinet without glue or fasteners of any kind. The top dimensions will be such that it will overhang the cabinet perimeter by 1" (25.4mm). Its weight shall be included in the test as live load. Before conducting the test, a visual examination shall be conducted to verify that the unit configuration and setup conditions are appropriate. Operate doors and drawers. Doors should be free moving and latch properly. Inspect the unit for dimensions and note the fit of doors and drawers to the cabinet body. Open and close the drawer. The drawer should be free moving and function as specified by the manufacturer. Discontinue evaluation if unit is not in compliance or if malfunction is noted.

4.2  Cabinet Load Test -

4.2.1  Purpose of Test

The cabinet load test will challenge the structural integrity and load bearing capability of the cabinet construction. This test will demonstrate the ability of the cabinet to support heavy applied loads. This is not intended to test the functional characteristics of the cabinet under heavy loads.

4.2.2  Test Procedure

Verify that the cabinet is level and supported only by the levelers. Load the cabinet top by using 2000 pounds (907.2 Kg) of solid steel bars (per Section 3.1) stacked five high and spaced per Fig 2. After ten minutes, unload the cabinet.
4.2.3 Acceptance Level

The cabinet will have no signs of permanent failure. After the load is removed, inspect the levelers. Any deformation shall not interfere with the function of the leveling system.

4.3 Cabinet Concentrated Load Test

4.3.1 Purpose of Test

The purpose of this test is to challenge the functional characteristics of the cabinet when subjected to a concentrated load on the center of the cabinet top.

4.3.2 Test Procedure

Using solid weights or 10 pound (4.535 Kg) sand bags (per Section 3.1), apply a total of 200 pounds (90.718 Kg) to the top of the cabinet along the cabinet centerline (see Figure 3). Operate doors and drawers.

4.3.3 Acceptance Level

Door and drawer operation shall be normal under condition of test load. There shall be no signs of permanent deformation to front rail, cabinet joinery, doors, or drawers.

4.4 Cabinet Torsion

4.4.1 Purpose of Test

This test will evaluate the structural integrity of the cabinet construction when subjected to a torsional load.

4.4.2 Test Procedure

The cabinet shall be tested in its normal upright position, raised not less than four-inches off the floor and supported on rear and one front corner. The area of support under the cabinet shall be located not more than 6” (152.4mm) in from each supported corner. Secure the cabinet diagonally from the unsupported corner with seven solid steel bars per Section 3.1 (350 pounds (158.757 Kg) of weight), on the top of the cabinet to prevent overturning. Apply four solid steel bars (200 pounds [90.718 Kg] of weight) to the unsupported corner for a period of 24 hours (see Figure 4). Remove weight and place cabinet on the floor in its normal upright position. Observe cabinet joinery. Level the cabinet and measure the face and back of the cabinet across the diagonal corners.

Figure 3. Base Cabinet Concentrated Load Test

Figure 4. Base Cabinet Torsion Test Procedure
4.4.3 Acceptance Level

When returned to normal position, the operation of the cabinet shall be normal, and there will be no permanent damage. The difference between the two measurements taken from measuring the diagonal corners shall be no more than 1/8” (3.175mm).

4.5 Cabinet Submersion Test

Not applicable to Metal Casework

4.6 Spill Containment Test

Not applicable to Metal Casework

5.0 Doors

5.1 Door Hinge Test

5.1.1 Purpose of Test

This test will demonstrate the durability of the door, door attachment and its hardware (hinge leaf, screws, etc.) to an applied load of 200 pounds (90.72 Kg).

5.1.2 Test Procedure

Remove the shelf for this test. With unit and top set as described in Section 4.1, add sufficient weight to the top in order to prevent overturning. With cabinet door opened 90-degrees, hang a sling made up of two 100 pound (45.359 Kg) weights (shot bags or solid weights) over top of the door at a point 12” (304.8mm) out from the hinge centerline (see Figure 5). Slowly move door through two full cycles of the hinge at 160-degree arc. Remove weight and swing door through its full intended range of motion and close door.

5.1.3 Acceptance Level

The open door shall withstand a load of 200 pounds (90.72 Kg) when applied at a point 12”(304.8mm) from the hinge centerline without permanent damage. Operation of the door, after test shall show no significant permanent damage that will cause binding of the door or hinges or that will adversely affect operation of the catch.

5.2 Door Impact Test

5.2.1 Purpose of Test

This test will demonstrate the resistance of a 240 inch-pound (27.1 N-m) impact to the door face. Only units that extend below the work surface should be subjected to this test. This test should not be inclusive of glass doors.

5.2.2 Test Procedure

With unit and top set as described in Section 4.1, add sufficient weight to the top in order to prevent overturning. A 20 pound (9.07 Kg) sand bag (Section 3.1) shall be suspended and dropped
to provide an impact of 240 inch-pounds (27.1 N-m) at the center of the closed door. (See Fig 6.)

5.2.3 Acceptance Level

After the test, the door and catch shall operate normally and show no signs of permanent damage. A dent or depression is an indication of permanent damage. This test is not intended to evaluate the cabinet finish.

5.3 Door Cycle Test

5.3.1 Purpose of Test

This test will demonstrate the durability of the door hinge hardware to withstand 100,000 cycles as a reliable measure for longevity.

5.3.2 Test Procedure

This test shall be in conformance to the ANSI test procedure A156.9, Grade 1, requirements for cycle testing of doors. A cycling mechanism shall swing door 90-degrees. Door shall operate for 100,000 cycles with a speed not greater than 15 cycles per minute.

5.3.3 Acceptance Level

Door shall operate for the full cycle period without deterioration that will significantly affect the function of the door. The door shall operate freely without binding.

6.0 Drawers

6.1 Drawer Static Test

6.1.1 Purpose of Test

This test will demonstrate the ability to support a point load given to the front of the drawer and will challenge the drawer suspension system and the attachment of the drawer head to the drawer.

6.1.2 Test Procedure

With unit and top set as described in Section 4.1, add sufficient weight to the top in order to prevent overturning. Open the drawer to 13” (330.2mm) of travel and hang 150 pounds (68.03 Kg) from the drawer head at the centerline of the drawer for five minutes. Remove the weight and operate the drawer through the full cycle.

6.1.3 Acceptance Level

There shall be no interference with the normal operation of the drawer and the drawer head should remain tightly fastened to the drawer.

6.2 Drawer and Door Pull Test

6.2.1 Purpose of Test

This test will evaluate the strength of the pull and pull hardware.

Figure 8. Base Cabinet Door and Drawer Pull Horizontal Load Test Configuration
6.2.2 Test Procedure

Pulls are to be installed in accordance with manufacturer’s practice using specified attaching hardware and method. Block door and drawer closed. Using a force gauge attached with a 1” (25.4mm) wide bracket (see Figure 8), apply a force of 50 pounds (22.68 Kg), for 15 seconds, perpendicular to each pull. Revise setup to apply force downward (see Figure 9).

6.2.3 Acceptance Level

Pulls shall resist force without breakage. After completion of test and removal of weight, there shall be no significant permanent deformation.

6.3 Drawer Impact Test

6.3.1 Purpose of Test

This test will demonstrate the resistance to impact of the drawer bottom.

6.3.2 Test Procedure

Remove drawer; support each corner with 2”x2”x1” (50.8 x 50.8 x 25.4 mm) supports. Drop a 10 pound (4.545 Kg) sand or shot bag from a height of 24” (609.6 mm) into the bottom of the drawer at the center of the width of the drawer.

6.4 Drawer Internal Rolling Impact Test

6.4.1 Purpose of Test

This test will evaluate the strength of the drawer head, bottom, and back as a result of opening and closing the drawer with a rolling load.

6.4.2 Test Procedure

Position the drawer on a table at a 45-degree angle per Figure 7. Place a 2” (50.8mm) diameter by 12” (304.8mm) long steel rod (approximately 10 pounds (4.545 Kg)) 13” (330.2mm) from the target impact area such that the rod will roll freely to impact the back of the drawer. Subject the back to three impacts and reverse the drawer to subject the front to three additional impacts.
6.4.3 Acceptance Level

The drawer shall show no permanent damage. All joinery shall be intact and the drawer, when replaced in the unit, shall operate normally. Minor scratches and dents are acceptable.

6.5 Drawer Cycle Test

6.5.1 Purpose of Test

This test is intended to replicate years of operation of a drawer under full load.

6.5.2 Test Procedure

Attach a bracket to the center of the drawer front by bolting it through the drawer front and body. Attach a cycling mechanism to the bracket using a free floating poly block and pin.

Figure 11. Drawer Cycling Mechanism Test Configuration

Laboratory Load – 100 pounds (45.36kg) A static of 100 pounds (45.35kg) (using ten 10-pound [4.54kg] sandbags per Section No. 3.1) shall be uniformly distributed in the drawer. Measure force required to activate the drawer. Operate from a closed position to within ¼” (6.35mm) of full extension for 50,000 cycles at a rate not to exceed 10 cycles per minute.

6.5.3 Acceptance Level

The drawer shall operate freely without evidence of dragging, rubbing or binding. The force required to open and close loaded drawer shall not be greater than 8 pounds (3.63kg) to activate hardware.*

*The American’s with Disabilities Act (ADA) requires a force no greater than five pounds to activate hardware. The load rating in this document is intended only for testing conditions where loads challenge the durability of the hardware. Under actual conditions, drawer loading should be reduced to levels that result in compliance with ADA as applicable.

7.0 Shelving

7.1 Description of Test Unit

Metal shelving shall be tested using the following procedure. The shelves to be tested are described in Sect. 4.1 and 9.1 “Description of Test Cabinet”.

7.2 Shelf Load Test

7.2.1 Purpose of Test

This test will demonstrate the ability of a shelf and its mounting hardware to support normal laboratory loads.

7.2.2 Test Procedure

A shelf shall be mounted in the manner in which it is designed. Measure the distance from the underside of the shelf to a reference point perpendicular to the center of the shelf. Use shot or sand bags weighing 10 pounds (4.54 Kg) each. Unless otherwise specified, load the shelf uniformly to 40 pounds (18.14 Kg) per square foot of shelf area to a maximum of 200 pounds (90.72 Kg). Measure the deflection on the shelf by measuring the distance to the reference point and calculating the difference between the two
measurements. Record data and remove load from the shelf.

7.2.3 Acceptance Level

The allowable maximum deflection of a shelf is 1/180 of the span and not in excess of .25" (6.35mm). The following formula may be used to calculate the approximate deflection expected from a uniformly distributed load:

\[ D(\text{max.}) = \frac{5W L^3}{384 E I} \]

WHERE:

- \( D \) = Deflection in inches (Maximum 1/180 span, not to exceed .25" (6.35mm)).
- \( W \) = (Design Load) x (Shelf Depth in Inches) x (Shelf Span in Inches) (Design Load = 40 pounds (18.14 Kg) / square foot divided by 144)
- \( "W" \) shall not exceed 200 pounds (90.72 Kg).
- \( L \) = Span between supports in inches
- \( E \) = Modulus of Elasticity Steel = 29 * 10^6 psi
- \( I \) = Cross section moment of inertia.

8.0 Cabinet Surface Finish Tests

8.1 Chemical Spot Test

Users should consider the chemical and staining agents that might be used near the laboratory casework. Common guidelines can be found by referring to: The casework manufacturer printed data for chemical and stain resistance, Because chemical and stain resistance is affected by concentration, time, temperature, humidity, housekeeping and other factors, it is recommended that users test samples in their actual environment with the substances they use.

8.1.1 Purpose of Test

The purpose of the chemical spot test is to evaluate the resistance a finish has to chemical spills.

Note: Many organic solvents are suspected carcinogens, toxic and/or flammable. Great care should be exercised to protect personnel and the environment from exposure to harmful levels of these materials.

8.1.2 Test Procedure

Provide 2" x 2" (50.8mm v 50.8mm) 18 gauge CRS test sample with between 2 and 4 mils of the manufacturer’s standard paint finish applied. The sample to be tested for chemical resistance as described herein.

Place panel on a flat surface, clean with soap and water and blot dry. Condition the panel for 48-hours at 73º +/- 3ºF (23º +/- 2ºC) and 50 +/- 5% relative humidity or the currently accepted guideline set by ASTM. Test the panel for chemical resistance using forty-nine different chemical reagents by one of the following methods.

Method A - Test volatile chemicals by placing a cotton ball saturated with reagent in the mouth of a 1-oz. (29.574cc) bottle and inverting the bottle on the surface of the panel.

Method B - Test non-volatile chemicals by placing five drops of the reagent on the surface of the panel and covering with a 24mm watch glass, convex side down.

For both of the above methods, leave the reagents on the panel for a period of one hour. Wash off the panel with water, clean with detergent and naptha, and rinse with deionized water. Dry with a towel and evaluate after 24-hours at 73º +/- 3ºF (23º +/- 3ºC) and 50 +/- 5% relative humidity, or the currently accepted guideline set by ASTM using the following rating system.

Level 0 - No detectable change.
Level 1 - Slight change in color or gloss.
Level 2 - Slight surface etching or severe staining.
Level 3 - Pitting, cratering, swelling, or erosion of coating. Obvious and significant deterioration.

Note: Percentages are by volume.
8.1.3 Acceptance Level

Results will vary from manufacturer to manufacturer due to differences in finish formulations. Laboratory grade finishes shall result in no more than four (4) Level 3 conditions. Individual test results, for the specified 49 reagents, will be verified with the established third party, independent SEFA 8 test submittal form. Suitability for a given application is dependent upon the chemicals used in a given laboratory.

8.2 Hot Water Test

8.2.1 Purpose of Test

The purpose of this test is to insure the surface is resistant to hot water.

8.2.2 Test Procedure

Hot water (190°F to 205°F [88°C to 96°C]) shall be allowed to trickle (with a steady stream and at a rate of not less than 6 ounces [177.44cc] per minute) on the finished surface, which shall be set at an angle of 45°, for a period of five minutes.

8.2.3 Acceptance Level

After cooling and wiping dry, the finish shall show no visible effect from the hot water.

8.3 Impact Test

8.3.1 Purpose of Test

The purpose of this test is to evaluate the ductility of the coating.

8.3.2 Test Procedure

An 18 gauge CRS sample panel shall measure approximately 14” x 24” (355.6mm x 609.6mm). The panel shall have between 2 and 4 mills of the manufactures standard paint finish applied.

Position the panel on a smooth concrete floor. A one-pound ball (approximately 2” [50.8mm] in diameter) shall be dropped from a distance of 12” (304.8mm) onto a flat horizontal surface.
8.3.3 Acceptance Level

There shall be no visual evidence to the naked eye of cracks or checks in the finish due to impact.

8.4 Paint Adhesion Test

8.4.1 Purpose of Test

The paint adhesion test is used to determine the bond of the coating to steel.

8.4.2 Test Procedure

Using one of the samples described in section 10.1.2, perform the following test.

This test is based on ASTM D3359-02 “Standard Test Methods for Measuring Adhesion by Tape Test” – Test Method B”. Two sets of six parallel lines 2mm apart shall be cut with a razor blade to intersect at right angles thus forming a grid of 25 squares. The cuts shall be made just deep enough to go through the coating, but not into the substrate. Brush the grid area lightly with a soft brush, and then place a piece of tape over the grid. Rub the tape firmly with the eraser of a pencil to ensure good contact. Remove the tape by rapidly pulling it back upon itself as close to an angle of 180° as possible.

8.4.3 Acceptance Level

A 4B rating or better (ninety five percent or more of the grid area shall show finish intact.

8.5 Paint Hardness Test

8.5.1 Purpose of Test

The paint hardness test is used to determine the resistance of the coatings to scratches.

8.5.2 Test Procedure

This test is based on ASTM D3363-0 “Standard Test Method for Film Hardness by Pencil Test”. Using one of the samples described in section 10.1.2, perform the following test.

Clip a corner of the sample at 45° exposing a raw metal edge. Place the sample on a raw metal base plate so that the exposed metal edge of the sample makes contact with the turned up side of the base plate (see Figure 12).

Remove approximately 6mm of wood from a 4H pencil, being careful to leave an undisturbed smooth cylinder of lead. Holding the pencil at an angle of 90° to an abrasive paper, rub the lead against the paper maintaining an exact angle of 90° until a flat smooth and circular cross section is obtained. On the other end of the pencil remove approximately 13mm of wood from one half of the pencil (see Figure 13). Install the pencil into a Sheen model 720N Pencil Scratch Hardness Tester. Connect a continuity meter to the base plate and to the top of the pencil, being sure to make good contact with the exposed portion of the lead.

Following the manufacturers instructions place the tester on the surface of the test sample and push it forward approximately 13mm. Rotate the pencil 90° in the holder and repeat the test to one side of the first test. Repeat this two more times for a total of four tests, each with a different quadrant of the pencil lead.

8.5.3 Acceptance Level

The paint finish shall withstand the abrasion of a 4H pencil without penetrating through to the substrate and completing a continuous circuit.
8.6 | Dart Impact Test
---|---
Not Applicable to Metal Casework.

8.7 | Edge Delaminating Test
---|---
Not Applicable to Metal Casework.

8.8 | Edge Impact Test
---|---
Not Applicable to Metal Casework.

8.9 | Wear Resistance (Abrasion) Test
---|---
Not Applicable to Metal Casework.

9.0 | Wall, Counter Mounted, and Tall Units
---|---

9.1 | Description of Test Cabinet
---|---
Evaluation shall be conducted on a wall mounted cabinet with nominal dimensions as follows: 48” (1,219.2mm) +/- 1” wide, 30” (762mm) +/- 1” high, and 12” (304.8mm) +/- 1” deep. The wall cabinet shall be manufactured to manufacturers’ standard construction and practices. The wall cabinet shall have two (2) doors and two (2) shelves. Shelves shall be evaluated per Section 7.0 (Shelving). The unit and shelves shall be mounted in a manner recommended by the manufacturer. A visual examination shall be conducted to verify that the configuration and installation comply with these conditions. Discontinue evaluation if unit is not in compliance or if malfunction is noted.

9.2 | Wall Cabinet Load Test
---|---

9.2.1 | Purpose of Test
---|---
The wall mounted load test will demonstrate the strength of the back of the wall cabinet as well as the joinery of the cabinet and function of doors when the unit is subjected to loads normally expected for laboratory furniture.

9.2.2 | Test Procedure
---|---
Using sand or shot bags weighing 10 pounds (4.55 Kg) each, load cabinet bottom, each shelf, and top uniformly with 40 pounds (18.18 Kg) per square foot to a maximum of 200 pounds (90.91 Kg) each. Maximum load to any cabinet shall not exceed 600 pounds (272.73 Kg) (a maximum of 200 pounds [90.91 Kg] loaded to each bottom, a minimum of one shelf loaded per Section 7.0, and the top) regardless of the number of shelves. Test to be performed with doors closed.

9.2.3 | Acceptance Level
---|---
With weights in place, after a period of 24 hours, operate doors through full travel to verify normal operation of doors. Remove weights and operate doors to verify normal operation. Verify that there is no significant permanent deflection of cabinet top, cabinet back, cabinet bottom, or shelves. After weights are removed, the cabinet shall show no permanent damage to the cabinet, cabinet bottom, or shelves.

10.0 | Tables
---|---

10.1 | Description of Test Unit
---|---
The table for evaluation shall be a standing height, four legged, free standing table. The table shall be nominally ±1” (25.4mm) 60” (1,524mm) long, 23” (584.2mm) deep and 35” (889mm) high (see Fig. 15). Leg and apron size and construction shall be to manufacturer’s specification. A top of 1” (25.4mm) thick 37-50 pcf medium density fiberboard shall be mounted on the table in the manner recommended by the manufacturer. The top dimensions will be such that it will overhang...
the cabinet perimeter by 1”. Its weight shall be included in the test as live load. Tables can be represented by a very large range of styles and designs.

10.2 Table Static Load

10.2.1 Purpose of Test

This test will challenge the table components to loads that are used in the laboratory.

10.2.2 Test Procedure

Load the table top by using solid steel bars (per Section 3.1), each weighing 50 pounds (22.68 Kg), stacked evenly and spaced per Figure 16. These evenly distributed loads should be no less than 600 pounds (272.16 Kg) for free standing tables. Include the weight of the working surface as live load.

10.2.3 Acceptance Level

No structural breakage shall result from application of the load. With the full load, the apron rails shall not deflect more than 1/360 of the span of the table and not to exceed 1/8” (3.175mm). In the case of a table with a drawer, the deflection of the rail shall not interfere with the function of the drawer. After the load is removed, inspect the table for structural damage.

10.3 Table Racking

10.3.1 Purpose of Test

This test will demonstrate the structural integrity of the table construction when subjected to a racking load. Most racking failures occur upon dragging an unloaded table across a floor. The ability of a table to resist a racking load will indicate less damage to the structure. The following tests were based on and adapted from ANSI/BIFMA X5.5-1989 American National Standard for Office Furnishings “Desk Products Tests.” Adjustments have been made to better accommodate the specific applications of tables used in laboratories.

10.3.2 Test Procedure

The table shall have a common two-by-four wood rail clamped on the centerline of the top parallel to the ends of the table. The table shall then be
positioned at 45º, with one pair of legs on the floor and the other raised and supported (see Figure 17). To prevent the table from tipping over, attach a cable to the end rail of the table and to the wall. The attachment of the cable at the wall must be equal to or less than the height of the attachment at the table. The table shall then have 250 pounds (113.398 Kg) of weight (five 50-pound (22.679 Kg) bars) placed on its top and held in place by the two-by-four wood rail. The unit shall remain in this position for seventy-two hours. The unit shall be lowered without shock to the leveled surface and the general operation of the drawers shall be evaluated.

10.3.3 Acceptance Level

When returned to normal position, the operation of the table shall be normal, and there will be no permanent damage.

Endnotes

1This format has been adapted from the BIFMA American National Standard format, X5.5 - 1989.

2Ibid. p 8.


11Webster’s Ninth New Collegiate Dictionary, 1988, p 980.

LABORATORY FURNITURE
CERTIFICATE OF PERFORMANCE

____________________________________________ certifies that its laboratory furniture identified as

(Company Name)

___________________________________ , has been tested in conformance with the full requirements

(Test Unit)

of the **SEFA 8-M-2016 Recommended Practices** with results noted below.

Full documentation of the test results is available upon request in a bound report that includes a
detailed description of the test unit and procedures, witnesses results and appropriate drawings or
photographs of the test unit and procedures.

<table>
<thead>
<tr>
<th>TEST</th>
<th>TEST RESULTS PASS/FAIL</th>
<th>TEST</th>
<th>TEST RESULTS PASS / FAIL</th>
<th>TEST</th>
<th>TEST RESULTS PASS / FAIL</th>
</tr>
</thead>
<tbody>
<tr>
<td>4.2</td>
<td></td>
<td>6.2</td>
<td></td>
<td>8.2</td>
<td></td>
</tr>
<tr>
<td>4.3</td>
<td></td>
<td>6.3</td>
<td></td>
<td>8.3</td>
<td></td>
</tr>
<tr>
<td>4.4</td>
<td></td>
<td>6.4</td>
<td></td>
<td>8.4</td>
<td></td>
</tr>
<tr>
<td>5.1</td>
<td>@200 lbs.</td>
<td>6.5</td>
<td>@ 100 lbs.</td>
<td>8.5</td>
<td></td>
</tr>
<tr>
<td>5.2</td>
<td></td>
<td>6.5</td>
<td>@ 150 lbs.</td>
<td>9.2</td>
<td></td>
</tr>
<tr>
<td>5.3</td>
<td></td>
<td>7.2</td>
<td>Deflection Measured</td>
<td>10.2</td>
<td></td>
</tr>
<tr>
<td>6.1</td>
<td></td>
<td>8.1</td>
<td>See Attached Form</td>
<td>10.3</td>
<td></td>
</tr>
</tbody>
</table>

**COMPANY INFORMATION**

Name: 
Address: 

**TEST SUPERVISOR INFORMATION**

Name: 
Title: 
Signature: 

**COMPANY OFFICER INFORMATION**

Name: 
Title: 
Signature: 

Telephone: 
Fax: 

Date: 
## CHEMICAL RESISTANCE TESTING – 8-M-2016

**Date of Test:** __________________________  **Sample Description:** _________________________  

**Type of Material Coated:** ____________________  **Coating Type:** ______________________________  

### Rating Scale:
- **Level 0** – No Detectable Change  
- **Level 1** – Slight Change in Color or Gloss  
- **Level 2** – Slight Surface Etching or Severe Staining  
- **Level 3** – Pitting, Cratering, Swelling, Erosion of Coating, Obvious and Significant Deterioration.

<table>
<thead>
<tr>
<th>#</th>
<th>CHEMICAL</th>
<th>RATING</th>
<th>COMMENTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Acetone, Amyl</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Acetone, Ethyl</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Acetic Acid 98%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Acetone</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Acid Dichromate 5%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Alcohol, Butyl</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Alcohol, Ethyl</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Alcohol, Methyl</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>Ammonium Hydroxide 28%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>Benzene</td>
<td></td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>Carbon Tetrachloride</td>
<td></td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>Chloroform</td>
<td></td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>Chromic Acid 60%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>Cresol</td>
<td></td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>Dichloroacetic Acid</td>
<td></td>
<td></td>
</tr>
<tr>
<td>16</td>
<td>Dimethylformamide</td>
<td></td>
<td></td>
</tr>
<tr>
<td>17</td>
<td>Dioxane</td>
<td></td>
<td></td>
</tr>
<tr>
<td>18</td>
<td>Ethyl Ether</td>
<td></td>
<td></td>
</tr>
<tr>
<td>19</td>
<td>Formaldehyde 37%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>20</td>
<td>Formic Acid 90%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>21</td>
<td>Furfural</td>
<td></td>
<td></td>
</tr>
<tr>
<td>22</td>
<td>Gasoline</td>
<td></td>
<td></td>
</tr>
<tr>
<td>23</td>
<td>Hydrofluoric Acid 37%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>24</td>
<td>Hydrofluoric Acid 48%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>25</td>
<td>Hydrogen Peroxide 30%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>26</td>
<td>Iodine, Tincture of</td>
<td></td>
<td></td>
</tr>
<tr>
<td>27</td>
<td>Methyl Ethyl Ketone</td>
<td></td>
<td></td>
</tr>
<tr>
<td>28</td>
<td>Methylene Chloride</td>
<td></td>
<td></td>
</tr>
<tr>
<td>29</td>
<td>Monochlorobenzene</td>
<td></td>
<td></td>
</tr>
<tr>
<td>30</td>
<td>Naphthalene</td>
<td></td>
<td></td>
</tr>
<tr>
<td>31</td>
<td>Nitric Acid 20%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>32</td>
<td>Nitric Acid 30%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>33</td>
<td>Nitric Acid 70%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>34</td>
<td>Phenol 90%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>35</td>
<td>Phosphoric Acid 85%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>36</td>
<td>Silver Nitrate, Saturated</td>
<td></td>
<td></td>
</tr>
<tr>
<td>37</td>
<td>Sodium Hydroxide 10%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>38</td>
<td>Sodium Hydroxide 20%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>39</td>
<td>Sodium Hydroxide 40%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>40</td>
<td>Sodium Hydroxide, Flake</td>
<td></td>
<td></td>
</tr>
<tr>
<td>41</td>
<td>Sodium Sulfide, Saturated</td>
<td></td>
<td></td>
</tr>
<tr>
<td>42</td>
<td>Sulfuric Acid 33%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>43</td>
<td>Sulfuric Acid 77%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>44</td>
<td>Sulfuric Acid 96%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>45</td>
<td>Sulfuric Acid 77%, and Nitric Acid 70% equal parts</td>
<td></td>
<td></td>
</tr>
<tr>
<td>46</td>
<td>Toluene</td>
<td></td>
<td></td>
</tr>
<tr>
<td>47</td>
<td>Trichloroethylene</td>
<td></td>
<td></td>
</tr>
<tr>
<td>48</td>
<td>Xylene</td>
<td></td>
<td></td>
</tr>
<tr>
<td>49</td>
<td>Zinc Chloride, Saturated</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**TEST PERFORMED BY:** ______________________________________  **DATE:** __________________________
Table Of Contents

Committee Members 205
Foreword 206
Sections
1.0 Scope 207
2.0 Purpose
3.0 Definitions 207
3.1 Description of Testing Apparatus
4.0 Base Cabinets 210
4.1 Description of Test Unit
4.2 Cabinet Load Test
   4.2.1 Purpose of Test
   4.2.2 Test Procedure
   4.2.3 Acceptance Level
4.3 Cabinet Concentrated Load Test
   4.3.1 Purpose of Test
   4.3.2 Test Procedure
   4.3.3 Acceptance Level
4.4 Cabinet Torsion
   4.4.1 Purpose of Test
   4.4.2 Test Procedure
   4.4.3 Acceptance Level
4.5 Cabinet Submersion Test
   4.5.1 Purpose of Test
   4.5.2 Test Procedure
   4.5.3 Acceptance Level
4.6 Spill Containment Test
   Not applicable to Phenolic Casework
5.0 Doors 212
5.1 Door Hinge Test
   5.1.1 Purpose of Test
   5.1.2 Test Procedure
   5.1.3 Acceptance Level
5.2 Door Impact Test
   Not applicable to Phenolic Casework
5.3 Door Cycle Test
   5.3.1 Purpose of Test
   5.3.2 Test Procedure
   5.3.3 Acceptance Level
6.0 Drawers 213
6.1 Drawer Static Test
   6.1.1 Purpose of Test
   6.1.2 Test Procedure
   6.1.3 Acceptance Level
6.2 Drawer and Door Pull Test
   Not applicable to Phenolic Casework
6.3 Drawer Impact Test
   6.3.1 Purpose of Test
   6.3.2 Test Procedure
   6.3.3 Acceptance Level
6.4 Drawer Internal Impact Test
   6.4.1 Purpose of Test
   6.4.2 Test Procedure
   6.4.3 Acceptance Level
6.5 Drawer Cycle Test
   6.5.1 Purpose of Test
   6.5.2 Test Procedure
   6.5.3 Acceptance Level
7.0 Shelving 215
7.1 Description of Test Unit
7.2 Shelf Load Test
   7.2.1 Purpose of Test
   7.2.2 Test Procedure
   7.2.3 Acceptance Level
8.0 Cabinet Surface Finish Tests 215
8.1 Chemical Spot Test
   8.1.1 Purpose of Test
   8.1.2 Test Procedure
   8.1.3 Acceptance Level
### Table Of Contents (cont’d)

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>8.2  Hot Water Test</td>
<td></td>
</tr>
<tr>
<td>8.2.1 Purpose of Test</td>
<td></td>
</tr>
<tr>
<td>8.2.2 Test Procedure</td>
<td></td>
</tr>
<tr>
<td>8.2.3 Acceptance Level</td>
<td></td>
</tr>
<tr>
<td>8.3  Impact Test</td>
<td></td>
</tr>
<tr>
<td>Not applicable to Phenolic Casework</td>
<td></td>
</tr>
<tr>
<td>8.4  Paint Adhesion Test</td>
<td></td>
</tr>
<tr>
<td>Not applicable to Phenolic Casework</td>
<td></td>
</tr>
<tr>
<td>8.5  Paint Hardness Test</td>
<td></td>
</tr>
<tr>
<td>Not applicable to Phenolic Casework</td>
<td></td>
</tr>
<tr>
<td>8.6  Dart Impact Test</td>
<td></td>
</tr>
<tr>
<td>Not applicable to Phenolic Casework</td>
<td></td>
</tr>
<tr>
<td>8.7  Edge Delaminating Test</td>
<td></td>
</tr>
<tr>
<td>Not applicable to Phenolic Casework</td>
<td></td>
</tr>
<tr>
<td>8.8  Edge Impact Test</td>
<td></td>
</tr>
<tr>
<td>Not applicable to Phenolic Casework</td>
<td></td>
</tr>
<tr>
<td>8.9  Wear Resistance (Abrasion) Test</td>
<td></td>
</tr>
<tr>
<td>Not applicable to Phenolic Casework</td>
<td></td>
</tr>
<tr>
<td>9.0  Wall Cabinets, Counter Mounted and Tall Units</td>
<td>217</td>
</tr>
<tr>
<td>9.1  Description of Test Unit</td>
<td></td>
</tr>
<tr>
<td>9.2  Load Test</td>
<td></td>
</tr>
<tr>
<td>9.2.1 Purpose of Test</td>
<td></td>
</tr>
<tr>
<td>9.2.2 Test Procedure</td>
<td></td>
</tr>
<tr>
<td>9.2.3 Acceptance Level</td>
<td></td>
</tr>
<tr>
<td>10.0 Tables</td>
<td></td>
</tr>
<tr>
<td>Not applicable to Phenolic Casework</td>
<td></td>
</tr>
<tr>
<td>Forms</td>
<td>218</td>
</tr>
</tbody>
</table>
SEFA 8-PH COMMITTEE MEMBERS

Committee Chair
Rick Johnson - ICI Scientific

Trespa, NA
TFI Inline Design, Inc.,
Foreword

SEFA Profile

The Scientific Equipment and Furniture Association (SEFA) is an international trade association comprised of manufacturers of laboratory furniture, casework, fume hoods and members of the design and installation professions. The Association was founded to promote this rapidly expanding industry and improve the quality, safety and timely completion of laboratory facilities in accordance with customer requirements.

SEFA Recommended Practices

SEFA and its committees are active in the development and promotion of Recommended Practices having domestic and international applications. Recommended Practices are developed by the association taking into account the work of other standard writing organizations. Liaison is also maintained with government agencies in the development of their specifications.

SEFA's Recommended Practices are developed in and for the public interest. These practices are designed to promote a better understanding between designers, architects, manufacturers, purchasers, and end-users and to assist the purchaser in selecting and specifying the proper product to meet the user's particular needs. SEFA's Recommended Practices are periodically updated. The Recommended Practices are numbered to include an annual suffix which reflects the year that they were updated. SEFA encourages architects to specify these Recommended Practices as follows: “SEFA 8PH-2014”.

SEFA Glossary of Terms

SEFA has developed a Glossary of Terms (SEFA 4-2010) for the purpose of promoting a greater understanding between designers, architects, manufacturers, purchasers and end users. The terms defined by SEFA are frequently used in contracts and other documents, which attempt to define the products to be furnished or the work involved. The Association has approved this Glossary in an effort to provide uniformity among those who use these terms. Where a specific Recommended Practice contains definitions which differ from those in the Glossary of Terms, then the definitions in the specific Recommended Practice should be used.

SEFA encourages all interested parties to submit additional terms or to suggest any changes to those terms already defined by the Association. The definitions should be used to help resolve any disputes that may arise or to incorporate the applicable terms in any contract or related documents.

SEFA Disclaimer

SEFA uses its best effort to promulgate Recommended Practices for the benefit of the public in light of available information and accepted industry practices. SEFA does not guarantee, certify or assure the safety or performance of any products, components, or systems tested, installed, or operated in accordance with SEFA Recommended Practices or that any tests conducted under its Recommended Practices will be non-hazardous or free from risk. SEFA encourages the use of third party independent testing where appropriate.

Note: Testing as described in this document must be performed and documented by a SEFA-approved third party testing facility. See Page 34 of the SEFA Desk Reference 5th Edition Version 2.0, or visit us at SEFALABS.COM for the most current list of SEFA-approved test labs.
1.0 Scope

The scope of this document is intended to provide manufacturers, specifiers, and users tools for evaluating the safety, durability, and structural integrity of phenolic laboratory grade furniture and complimentary items. This document is inclusive of casework (base units, wall mounted units, counter mounted units, tall units, tables and, shelving systems). Casework and shelving manufactured for laboratory use should be subjected to the tests and procedures outlined below.

Phenolic laboratory grade casework shall consist of base cabinets, wall cabinets, counter mounted cabinets, tall cabinets, and shelving.

Aggregate test results may vary by manufacturer. Procedures for testing performance criteria shall be as outlined in this document and results made available upon request. It is assumed that the test model reflects the performance criteria for all products. However there may be certain door/drawer configurations and/or sizes outside the test unit configuration identified that may not meet certain parts of this test. A test unit has been identified in this document with the sole purpose of obtaining continuity of procedures and results in a scientific format.

Great care should be exercised when heavy loads are applied to the cabinet and appropriate safety precautions taken to insure safety of testing personnel. Properly trained personnel should perform all tests. SEFA assumes no liability for damage or injury as a result of conducting these tests.

The acceptance levels are based on the cumulative field experience and laboratory testing of SEFA members based on actual needs of laboratories. This is a performance-based document. Specifications proscribing specific materials, hardware, finishes, workmanship or construction may or may not meet acceptance levels of this document. If prescriptive components of the specifications conflict with compliance of this document then the Architectural proscribed elements take precedence.

Testing as outlined in this document must be performed and documented by a SEFA-approved independent third party testing facility.

2.0 Purpose

The purpose of this document is to describe the distinguishing performance characteristics of solid phenolic core laboratory grade furniture and complimentary items. Furniture shall be of a type specifically designed and manufactured for installation and use in a laboratory.

Although aggregate test results may vary from manufacturer to manufacturer, procedures for testing performance criteria shall be as outlined in this document and results made available upon request. It is assumed that the test model reflects the performance criteria for all products regardless of construction, size, or style used. A test unit has been identified in this document with the sole purpose of obtaining continuity for procedures and results in a scientific format.

3.0 Definitions

Acceptance Levels - The acceptance level for each performance criteria is based on the cumulative experience of actual field testing and laboratory results of SEFA members. Acceptance levels describe the expected outcome of each test procedure.

ANSI/BIFMA - ANSI is the American National Standards Institute. Approval of an American National Standard requires verification by ANSI that the requirements for due process, consensus, and other criteria for approval have been met by the standards developer. BIFMA is the Business and Institutional Furniture Manufacturer’s Association, an association of manufacturers of desk products and the like.

Apparatus - A machine or group of machines and accessories.

Arithmetic Mean - A number obtained by dividing the sum of a set of quantities by the number of quantities in a set; average.

**Base Cabinets** - A base cabinet is a storage device consisting of two ends, a back, a face and may or may not include a top or top frame. The face may be open, to access the storage area, or may be outfitted with one or more drawers and/or doors. A base cabinet is always placed on the floor and normally supports a surface. The top surface is normally no more than 42” (1,067 mm) off the floor surface.

**Best Practices** - When given a choice of grade, the “best practice” is to select one that offers a well defined degree of control over the quality of workmanship, materials, and installation of a project. SEFA-8 Recommended Practices are written from a view of high quality laboratory furniture.

**Cabinet Depth (Deep)** - Given a front, bottom, two sides, and a top, the cabinet depth is a measure of the side of the cabinet, in its normal upright position, from the outside back to the outside front excluding doors and door fronts.

**Cabinet Height (High)** - Given a front, bottom, two sides, and a top, the cabinet height is a measure of the side of the cabinet, in its normal upright position, from the bottom edge of the side to the top, excluding any surface.

**Cabinet Width (Wide)** - Given a front, bottom, two sides, and a top, the cabinet width is a measure of the front of the cabinet in its normal upright position from one side to the other.

**Casework** - Base and wall cabinets, display fixtures, and storage shelves. The generic term for both “boxes” and special desks, reception counters, nurses stations and the like. Generally includes the tops and work surfaces.

**Chase (Plumbing Area)** - Space located behind the back of the base cabinet used to house plumbing or electric lines.

**Combination Unit** - A base unit of the type that has both door(s) and drawer(s).

**Counter Mounted Cabinet** - A counter mounted cabinet is a wall cabinet (usually with a height of approximately 48” [1,219 mm] and is typically mounted on the work surface or shelf, as in a reagent shelf).

**Cupboard (Door Unit)** - That portion of the cabinet with no drawer(s) that may be enclosed by doors.

**Drawer** - A sliding storage box or receptacle opened by pulling out and closed by pushing in.

**Free Standing** - Requiring no support or fastening to other structures.

**Hardware** - Items such as screws, pulls, hinges, latches, locks, and drawer slides used in the construction of casework.

**Joinery** - The junction of two pieces intended to be permanently connected.

**Laboratory Furniture** - Furniture designed and manufactured for installation and use in a laboratory.

**Latch** - A piece of hardware designed to hold a door closed.

**Leveling Screws (Levelers)** - Threaded components designed to allow adjustment of the cabinet vertically as needed for leveling.

**Nominal Dimensions** - Not all cabinet manufacturers produce product to the identical dimensions. All dimensions given in this document are accurate to within five percent, which is considered nominal.

**Permanent Damage** - Destruction to material or joinery that would require repair in order to return to its original state.

**Permanent Deformation** - Deflection that has exceeded the limits of the product, thus changing the original shape of the product.

**Permanent Deterioration** - Erosion or corrosion of material such that the component will never return to its original shape.
Permanent Failure - See “permanent damage.”

Pulls - Articles of hardware used to grasp and open/close the door or drawer (see also hardware).

Rack Resistance - The ability of a product to resist stresses that tend to make the product distort and the drawers to become misaligned.

Rail - A horizontal member extending from one side of the cabinet to the other.

Reagent - A substance used because of its chemical or biological activity.

Removable Back - A panel located on the inside back of the base cabinet, which is removable in order to gain access to utilities.

Solid Phenolic Composite - Solid phenolic composite tops are a compression molded composite of a homogeneous core of organic fiber reinforced phenolic and may contain one or more integrally cured surfaces that are non-porous.

Submersion - Covered with water.

Tables - An article of furniture having a flat, horizontal surface supported by one or more support members (legs), and a frame (apron).

Tall Cabinet (Full Height Unit) - A tall cabinet is a storage device that consists of two ends, a top and bottom panel, a back and a face. The face may be open to access the storage area or may be outfitted with one or more drawers and/or door(s). A tall cabinet is always placed on the floor and is nominally 84” (2,134mm) high.

Torsion – A force acting at a distance which tends to twist or rotate an object or cabinet.

Uniformly Distributed – A force applied evenly over the area of a surface.

Unobstructed Entry - A cabinet is deemed to be unobstructed if access to the entire storage area is completely without obstacle.

Upright Position - A cabinet oriented in its intended position.

Wall Cabinet - A wall cabinet is a storage device consisting of two ends, a back, a top, bottom, and a face. The face may be open to access the storage area or may be outfitted with one or more door(s). The wall cabinet usually does not include a drawer. A wall cabinet is always mounted on a vertical surface such as a wall, a divider, panel or some other vertical structure. A wall cabinet is usually less than 48” (1,219mm) high.

Work Surface - A normally horizontal surface used to support apparatus at a convenient height above the floor. Work surfaces are normally positioned atop a base cabinet or table structure.

3.1 Description of Testing Apparatus

Solid Steel Bar - A square solid steel bar 2 1/2” (63mm) square, 28 1/4” (717mm) long, weighing 50 pounds (22.679 Kg).

Sand or Shot Bag (10 pounds [4.545 Kg]) - A bag of plastic or cloth with the approximate dimensions 10 9/16” (268mm) x 11” (279mm) as in typical “gallon size re-closable stor-age bags.” Filled with enough sand or shot so that contents weigh 10 pounds (4.545 Kg).

Sand Bag (20 pounds [9.071 Kg]) - Two 10 pound (4.545 Kg) sand bags bound together.

Shot Bag (100 lbs. [45.359 Kg]) - A plastic or cloth bag of sufficient size to contain 100 pounds (45.359 Kg) of shot.

Cycling Mechanism - Per ANSI BHMA 156.9.-2003

Steel Rod - A 2” (51mm) diameter by 12” (305mm) long rod, approximately 10 pounds (4.535 Kg) in weight.

Hot Water - To be considered “hot water,” the temperature of the water must be between 190º F to 205º F (88º C to 96º C).

One Pound Ball - Solid steel sphere approximately 2” (51mm) in diameter.
4.0  Base Cabinets

4.1  Description of Test Cabinet

The base cabinet shall be a combination of cupboard and drawer per Figure 1. The base cabinet shall be 48" +/- 1" (1219.2mm +/- 25.4mm) wide, 36" +/-1" (914.4mm +/- 25.4mm) high, and 22" +/-1" (558 mm +/- 25.4mm) deep. Cabinet dimensions do not include drawer or door front thickness. The drawer shall be above the cupboard, full width and approximately one-fourth the height of the cabinet's face opening. Drawer shall be a minimum of 18" (457.2mm) deep outside dimension. When slides are used for drawers, slides shall be a minimum of 18" (457.2mm) deep. Cupboard shall be double-door design and provide unobstructed entry into the cabinet interior with the doors open. The unit shall contain one adjustable shelf.

The cabinet back shall be the removable type (per manufactures standard design as used for access to the plumbing or chase area) with the removable panel removed. Removable panel to be a minimum 36"x18" (914.4mm x 457.2mm). The cabinet shall have full height end panels with integral toeboard. The cabinet shall be free standing, squared and sitting 1" (25.4mm) off the floor atop four hardwood corner blocks 2" (50.8mm) square and 1" (25.4mm) high. A top of 1" (25.4mm) thick 37-50 pcf medium density fiberboard shall be positioned on the cabinet without glue or fasteners of any kind. The top dimensions will be such that it will overhang the cabinet perimeter by 1" (25.4mm).

Before conducting the test, a visual examination shall be conducted to verify that the unit configuration and setup conditions are appropriate. Operate doors and drawer. Doors should be free moving and latch properly. Inspect the unit for dimensions and note the fit of doors and drawers to the cabinet body. Open and close the drawer. The drawer should be free moving and function as specified by the manufacturer. Discontinue evaluation if unit is not in compliance or if malfunction is noted. Although aggregate test results may vary from manufacturer to manufacturer, procedures for testing performance criteria shall be as outlined in this document and results made available upon request. It is assumed that the test model reflects the performance criteria for all products regardless of construction, size, or style used. A test unit has been identified in this document with the sole purpose of obtaining continuity of procedures and results in a scientific format.

4.2  Cabinet Load Test -

4.2.1  Purpose of Test

The cabinet load test will challenge the structural integrity and load bearing capability of the cabinet construction. This test will demonstrate the ability of the cabinet to support heavy applied loads. This is not intended to test the functional characteristics of the cabinet under heavy loads.

4.2.2  Test Procedure

Verify that the cabinet is level. Remove drawer and open doors for testing purpose. Load the cabinet top by using 2000 pounds (907.184 Kg) of solid steel bars (per Section 3.1) stacked four high and spaced per Figure 2. After 24 hours, unload the cabinet.

4.2.3  Acceptance Level - The cabinet will have no permanent failure.
4.3   Cabinet Concentrated Load Test

4.3.1  Purpose of Test

The purpose of this test is to challenge the functional characteristics of the cabinet when subjected to a concentrated load on the center of the cabinet top.

4.3.2  Test Procedure

Using solid weights or 10 pound (4.535 Kg) sand bags (per Section 3.1), apply a total of 200 pounds (90.718 Kg) to the top of the cabinet along the cabinet centerline (see Figure 3). Operate doors and drawers.

4.3.3  Acceptance Level

Door and drawer operation shall be normal under condition of test load. There shall be no signs of permanent deformation to front rail, cabinet joinery, doors, or drawers.

4.4   Cabinet Torsion

4.4.1  Purpose of Test

This test will evaluate the structural integrity of the cabinet construction when subjected to a torsional load.

4.4.2  Test Procedure

The cabinet shall be tested in its normal upright position, raised not less than four-inches off the floor and supported on rear and one front corner. The area of support under the cabinet shall be located not more than 6” (152.4mm) in from each supported corner. Secure the cabinet diagonally from the unsupported corner with seven solid steel bars per Section 3.1 (350 pounds [158.757 Kg] of weight), on the top of the cabinet to prevent overturning. Apply four solid steel bars (200 pounds [90.718 Kg] of weight) to the unsupported corner for a period of 24 hours (see Figure 4). Remove weight and place cabinet on the floor in its normal upright position. Observe cabinet joinery. Level the cabinet and measure the face and back of the cabinet across the diagonal corners.
4.4.3 Acceptance Level

When returned to normal position, the operation of the cabinet shall be normal, and there will be no permanent damage. The difference between the two measurements taken from measuring the diagonal corners shall be no more than 1/8” (3.175mm).

4.5 Cabinet Submersion Test

4.5.1 Purpose of Test

This test will demonstrate the ability of a cabinet to resist wicking of moisture from the floor. Only units that rest on the floor or a unit where the base is within 2” (50.8mm) of the floor should be subjected to this test.

4.5.2 Test Procedure

The material thickness along the perimeter of the cabinet shall be measured on 6” (152.4mm) increments. Record the thickness of the material to be submerged in water. Calculate the arithmetic mean of the data taken. Place the entire test cabinet in its upright position such that the cabinet is submerged in a pan filled with 2” (50.8mm) of water. After 4 hours, remove the unit from the water and immediately measure the thickness of the material at the same points measured initially. Calculate the new arithmetic mean. After the unit has been allowed to dry, inspect for other damage.

4.5.3 Acceptance Level

The cabinet will show no permanent deformation or deterioration. Increase in thickness shall not exceed ten percent of the initial mean measurements.

4.6 Spill Containment Test

Not applicable to Phenolic Casework

5.0 Doors

5.1 Door Hinge Test

5.1.1 Purpose of Test

This test will demonstrate the durability of the door, door attachment and its hardware (hinge leaf, screws, etc.) to an applied load of 200 pounds (90.72 Kg).

5.1.2 Test Procedure

Remove the shelf for this test. With unit and top set as described in Section 4.1, add sufficient weight to the top in order to prevent overturning. With cabinet door opened 90-degrees, hang a sling made up of two 100 pound (45.359 Kg) weights (shot bags or solid weights) over top of the door at a point 12” (304.8mm) out from the hinge centerline (see Figure 5). Slowly move door through two full cycles of the hinge at 160-degree arc. Remove weight and swing door through its full intended range of motion and close door.

5.1.3 Acceptance Level

The open door shall withstand a load of 200 pounds (90.72 Kg) when applied at a point 12”(304.8mm) from the hinge centerline without permanent damage. Operation of the door, after test shall show no significant permanent damage that will cause binding of the door or hinges or that will adversely affect operation of the catch.

5.2 Door Impact Test

Not Applicable to Phenolic Casework.
5.3 Door Cycle Test

5.3.1 Purpose of Test

This test will demonstrate the durability of the door hinge hardware to withstand 100,000 cycles as a reliable measure for longevity.

5.3.2 Test Procedure

This test shall be in conformance to the ANSI test procedure A156.9, Grade 1, requirements for cycle testing of doors. A cycling mechanism shall swing door 90-degrees. Door shall operate for 100,000 cycles with a speed not greater than 15 cycles per minute.

5.3.3 Acceptance Level

Door shall operate for the full cycle period without deterioration that will significantly affect the function of the door. The door shall operate freely without binding.

6.0 Drawers

6.1 Drawer Static Test

6.1.1 Purpose of Test

This test will demonstrate the ability to support a point load given to the front of the drawer and will challenge the drawer suspension system and the attachment of the drawer head to the drawer.

6.1.2 Test Procedure

With unit and top set as described in Section 4.1, add sufficient weight to the top in order to prevent overturning. Open the drawer to 13” (330.2mm) of travel and hang 150 pounds (68.03 Kg) from the drawer head at the centerline of the drawer for five minutes. Remove the weight and operate the drawer through the full cycle.

6.1.3 Acceptance Level

There shall be no interference with the normal operation of the drawer and the drawer head should remain tightly fastened to the drawer.

6.2 Drawer and Door Pull Test

6.3 Drawer Impact Test

6.3.1 Purpose of Test

This test will demonstrate the resistance to impact of the drawer bottom.

6.3.2 Test Procedure

Remove drawer; support each corner with 2”x2”x1” (50.8 x 50.8 x 25.4 mm) supports. Drop a 10 pound (4.545 Kg) sand or shot bag from a height of 24” (609.6 mm) into the bottom of the drawer at the center of the width of the drawer. Remove the sand or shot bag.

6.3.3 Acceptance Level

No damage or breakout of the drawer bottom.

6.4 Drawer Internal Rolling Impact Test

6.4.1 Purpose of Test

This test will evaluate the strength of the drawer head, bottom, and back as a result of opening and closing.
closing the drawer with a rolling load.

### 6.4.2 Test Procedure

Position the drawer on a table at a 45-degree angle per Figure 7. Place a 2” (50.8mm) diameter by 12” (304.8mm) long steel rod (approximately 10 pounds [4.545 Kg]) 13” (330.2mm) from the target impact area such that the rod will roll freely to impact the back of the drawer. Subject the back to three impacts and reverse the drawer to subject the front to three additional impacts.

### 6.4.3 Acceptance Level

The drawer shall show no permanent damage. All joinery shall be intact and the drawer, when replaced in the unit, shall operate normally. Minor scratches and dents are acceptable.

### 6.5 Drawer Cycle Test

#### 6.5.1 Purpose of Test

This test is intended to test the drawer’s operation under full load. To be considered Laboratory Grade Solid Core Phenolic Casework, the mechanical drawer slides must be rated at a minimum, ANSI/BHMA A156.9 Grade 1.

#### 6.5.2 Test Procedure

Mechanical Suspension Systems – A dynamic load of 75 pounds (34.019 Kg) shall be uniformly distributed in the drawer (using ten 7 ½ pound (3.401 Kg) sand or shot bags per Section 3.1). Measure force required to activate the drawer. Operate over the full range of motion without engaging bumpers, stops or self-closing features for 50,000 cycles at a rate not to exceed 8 - 12 cycles per minute.

#### 6.5.3 Acceptance Level

The drawer shall operate freely without evidence of binding. The force required to open and close loaded drawer shall not be greater than 8 pounds to activate.*

*The American’s with Disabilities Act (ADA) requires a force no greater than five pounds to activate hardware. The load rating in this document is intended only for testing conditions where loads challenge the durability of the hardware. Under actual conditions, drawer loading should be reduced to levels that result in compliance with ADA as applicable.
7.0 Shelving

7.1 Description of Test Unit

Wood shelving shall be tested using the following procedure. The shelves to be tested are as described in section 9.1 “Description of Test Cabinet”.

7.2 Shelf Load Test

7.2.1 Purpose of Test

This test will demonstrate the ability of a shelf and its mounting hardware to support loads of 40 pounds (18.143 Kg) per square foot, not to exceed 200 pounds (90.718 Kg).

7.2.2 Test Procedure

A shelf shall be mounted in a manner in which it is designed. Measure the distance from the underside of the shelf to a reference point perpendicular to the center of the shelf. Use shot or sand bags weighing 10 pounds (4.535 Kg) each. Unless otherwise specified, load the shelf uniformly to 40 pounds (18.14 kg) per square foot of shelf area to a maximum of 200 pounds (90.71 Kg). Measure the deflection of the shelf by measuring the distance to the reference point and calculating the difference between the two measurements. Record data and remove the load from the shelf.

7.2.3 Acceptance Level

Different materials will perform differently to the loads based on the Modulus of Elasticity of the material and the cross section moment of inertia for the shape of the material. Longer shelves will support less loads than shorter shelves. The allowable maximum deflection of a shelf is 1/180 of the span and not in excess of .25” (6.35mm).

8.0 Cabinet Surface Finish Tests

8.1 Chemical Spot Test

Users should consider the chemical and staining agents that might be used near the laboratory casework. Common guidelines can be found by referring to: The casework manufacturer printed data for chemical and stain resistance. Because chemical and stain resistance is affected by concentration, time, temperature, humidity, housekeeping and other factors, it is recommended that users test samples in their actual environment with the substances they use.

8.1.1 Purpose of Test

The purpose of the chemical spot test is to evaluate the resistance a finish has to chemical spills.

Note: Many organic solvents are suspected carcinogens, toxic and/or flammable. Great care should be exercised to protect personnel and the environment from exposure to harmful levels of these materials.

8.1.2 Test Procedure

Obtain one sample panel measuring 14” x 24” (355.6mm x 609.6mm). The received sample to be tested for chemical resistance as described herein.

Place panel on a flat surface, clean with soap and water and blot dry. Condition the panel for 48-hours at 73º +/- 3ºF (23º +/- 2ºC) and 50 +/- 5% relative humidity or the currently accepted guideline set by ASTM. Test the panel for chemical resistance using forty-nine different chemical reagents by one of the following methods.

Method A - Test volatile chemicals by placing a cotton ball saturated with reagent in the mouth of a 1-oz. (29.574cc) bottle and inverting the bottle on the surface of the panel.

Method B - Test non-volatile chemicals by placing five drops of the reagent on the surface of the panel and covering with a 24mm watch glass, convex side down.

For both of the above methods, leave the reagents on the panel for a period of one hour. Wash off the panel with water, clean with detergent and naptha, and rinse with deionized water. Dry with a towel and evaluate after 24-hours at 73º +/- 3ºF.
(23º +/- 2ºC) and 50 +/- 5% relative humidity, or the currently accepted guideline set by ASTM using the following rating system.

**Level 0** - No detectable change.
**Level 1** - Slight change in color or gloss.
**Level 2** - Slight surface etching or severe staining.
**Level 3** - Pitting, cratering, swelling, or erosion of coating. Obvious and significant deterioration.

Note: Percentages are by volume.

**8.1.3 Acceptance Level**

Range of results is provided to establish the acceptable range for a Laboratory Grade Finish. Results will vary from manufacturer to manufacturer due to differences in finish formulations. Laboratory grade finishes shall result in no more than four (4) Level 3 conditions. Individual test results, for the specified 49 reagents, will be verified with the established third party, independent SEFA 8 test submittal form. Suitability for a given application is dependent upon the chemicals used in a given laboratory.

**8.2 Hot Water Test**

**8.2.1 Purpose of Test**

The purpose of this test is to insure the surface is resistant to hot water.

**8.2.2 Test Procedure**

Hot water (190ºF to 205ºF [88ºC to 96ºC]) shall be allowed to trickle (with a steady stream and at a rate of not less than 6 ounces [177.44cc] per minute) on the finished surface, which shall be set at an angle of 45º, for a period of five minutes.

**8.2.3 Acceptance Level**

After cooling and wiping dry, the finish shall show no visible effect from the hot water.

**8.3 Ball Impact Test**

*Not Applicable to Phenolic Casework.*
8.4 Paint Adhesion Test
Not Applicable to Phenolic Casework.

8.5 Paint Hardness Test
Not Applicable to Phenolic Casework.

8.6 Dart Impact Test
Not Applicable to Phenolic Casework.

8.7 Edge Delaminating Test
Not Applicable to Phenolic Casework.

8.8 Edge Impact Test
Not Applicable to Phenolic Casework.

8.9 Wear Resistance (Abrasion) Test
Not Applicable to Phenolic Casework.

9.0 Wall, Counter Mounted, and Tall Units

9.1 Description of Test Cabinet
Evaluation shall be conducted on a wall mounted cabinet with nominal dimensions as follows: 48” (1,219.2mm) +/- 1” wide, 30” (762mm) +/- 1” high, and 12” (304.8mm) +/- 1” deep. The wall cabinet shall be manufactured to manufacturers’ standard construction and practices. The wall cabinet shall have two (2) doors and two (2) shelves. Shelves shall be evaluated per Section 7.0 (Shelving). The unit and shelves shall be mounted in a manner recommended by the manufacturer. A visual examination shall be conducted to verify that the configuration and installation comply with these conditions. Discontinue evaluation if unit is not in compliance or if malfunction is noted.

9.2 Wall Cabinet Load Test

9.2.1 Purpose of Test
The wall mounted load test will demonstrate the strength of the back of the wall cabinet as well as the joinery of the cabinet and function of doors when the unit is subjected to loads normally expected for laboratory furniture.

9.2.2 Test Procedure
Using sand or shot bags weighing 10 pounds (4.55 Kg) each, load cabinet bottom, each shelf, and top uniformly with 40 pounds (18.18 Kg) per square foot to a maximum of 200 pounds (90.91 Kg) each. Maximum load to any cabinet shall not exceed 600 pounds (272.73 Kg) (a maximum of 200 pounds [90.91 Kg] loaded to each bottom, a minimum of one shelf loaded per Section 7.0, and the top) regardless of the number of shelves. Test to be performed with the doors closed.

9.2.3 Acceptance Level
With weights in place, after a period of 24 hours, operate doors through full travel to verify normal operation of doors. Remove weights and operate doors to verify normal operation. Verify that there is no significant permanent deflection of cabinet top, cabinet back, cabinet bottom, or shelves. After weights are removed, the cabinet shall show no permanent damage to the cabinet, cabinet bottom, or shelves.

10.0 Tables
Not Applicable to Phenolic Casework.
LABORATORY FURNITURE
CERTIFICATE OF PERFORMANCE

________________________________________ certifies that its laboratory furniture identified as

(Company Name)

________________________________________, has been tested in conformance with the full requirements

(Test Unit)

of the **SEFA 8-PH-2014 Recommended Practices** with results noted below.

Full documentation of the test results is available upon request in a bound report that includes a
detailed description of the test unit and procedures, witnesses results and appropriate drawings or
photographs of the test unit and procedures.

<table>
<thead>
<tr>
<th>TEST</th>
<th>TEST RESULTS PASS/FAIL</th>
<th>TEST</th>
<th>TEST RESULTS PASS / FAIL</th>
</tr>
</thead>
<tbody>
<tr>
<td>4.2</td>
<td></td>
<td>6.3</td>
<td></td>
</tr>
<tr>
<td>4.3</td>
<td></td>
<td>6.4</td>
<td></td>
</tr>
<tr>
<td>4.4</td>
<td></td>
<td>6.5</td>
<td></td>
</tr>
<tr>
<td>4.5</td>
<td></td>
<td>7.2</td>
<td></td>
</tr>
<tr>
<td>5.1</td>
<td></td>
<td>8.1</td>
<td><strong>See Attached Form</strong></td>
</tr>
<tr>
<td>5.3</td>
<td></td>
<td>8.2</td>
<td></td>
</tr>
<tr>
<td>6.1</td>
<td></td>
<td>9.2</td>
<td></td>
</tr>
</tbody>
</table>

Name:                        Name:
Address:                     Title:

Signature:

Telephone:                   COMPANY OFFICER INFORMATION
Fax                           Name:

Date:                        Title:

Signature:
### CHEMICAL RESISTANCE TESTING – 8-PH-2014

Date of Test: ____________________________ Sample Description: _________________________

Type of Material Coated: ____________________ Coating Type: ______________________________

Rating Scale:
- Level 0 – No Detectable Change
- Level 1 – Slight Change in Color or Gloss
- Level 2 – Slight Surface Etching or Severe Staining
- Level 3 – Pitting, Cratering, Swelling, Erosion of Coating, Obvious and Significant Deterioration.

<table>
<thead>
<tr>
<th>#</th>
<th>CHEMICAL</th>
<th>RATING</th>
<th>COMMENTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Acetate, Amyl</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Acetate, Ethyl</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Acetic Acid 98%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Acetone</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Acid Dichromate 5%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Alcohol, Butyl</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Alcohol, Ethyl</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Alcohol, Methyl</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>Ammonium Hydroxide 28%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>Benzene</td>
<td></td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>Carbon Tetrachloride</td>
<td></td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>Chloroform</td>
<td></td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>Chromic Acid 60%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>Cresol</td>
<td></td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>Dichloroacetic Acid</td>
<td></td>
<td></td>
</tr>
<tr>
<td>16</td>
<td>Dimethylformamide</td>
<td></td>
<td></td>
</tr>
<tr>
<td>17</td>
<td>Dioxane</td>
<td></td>
<td></td>
</tr>
<tr>
<td>18</td>
<td>Ethyl Ether</td>
<td></td>
<td></td>
</tr>
<tr>
<td>19</td>
<td>Formaldehyde 37%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>20</td>
<td>Formic Acid 90%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>21</td>
<td>Furfural</td>
<td></td>
<td></td>
</tr>
<tr>
<td>22</td>
<td>Gasoline</td>
<td></td>
<td></td>
</tr>
<tr>
<td>23</td>
<td>Hydrofluoric Acid 37%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>24</td>
<td>Hydrofluoric Acid 48%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>25</td>
<td>Hydrogen Peroxide 30%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>26</td>
<td>Iodine, Tincture of Methanol</td>
<td></td>
<td></td>
</tr>
<tr>
<td>27</td>
<td>Methyl Ethyl Ketone</td>
<td></td>
<td></td>
</tr>
<tr>
<td>28</td>
<td>Methylene Chloride</td>
<td></td>
<td></td>
</tr>
<tr>
<td>29</td>
<td>Monochlorobenzene</td>
<td></td>
<td></td>
</tr>
<tr>
<td>30</td>
<td>Naphthalene</td>
<td></td>
<td></td>
</tr>
<tr>
<td>31</td>
<td>Nitric Acid 20%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>32</td>
<td>Nitric Acid 30%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>33</td>
<td>Nitric Acid 70%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>34</td>
<td>Phenol 90%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>35</td>
<td>Phosphoric Acid 85%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>36</td>
<td>Silver Nitrate, Saturated</td>
<td></td>
<td></td>
</tr>
<tr>
<td>37</td>
<td>Sodium Hydroxide 10%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>38</td>
<td>Sodium Hydroxide 20%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>39</td>
<td>Sodium Hydroxide 40%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>40</td>
<td>Sodium Hydroxide, Flake</td>
<td></td>
<td></td>
</tr>
<tr>
<td>41</td>
<td>Sodium Sulfide, Saturated</td>
<td></td>
<td></td>
</tr>
<tr>
<td>42</td>
<td>Sulfuric Acid 33%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>43</td>
<td>Sulfuric Acid 77%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>44</td>
<td>Sulfuric Acid 96%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>45</td>
<td>Sulfuric Acid 77%, and Nitric Acid 70%, equal parts</td>
<td></td>
<td></td>
</tr>
<tr>
<td>46</td>
<td>Toluene</td>
<td></td>
<td></td>
</tr>
<tr>
<td>47</td>
<td>Trichloroethylene</td>
<td></td>
<td></td>
</tr>
<tr>
<td>48</td>
<td>Xylene</td>
<td></td>
<td></td>
</tr>
<tr>
<td>49</td>
<td>Zinc Chloride, Saturated</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Test performed by: ____________________________ Date: _________________
SEFA 8-PL-2016
Laboratory Grade Plastic Laminate Casework
# Table of Contents

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Committee Members</td>
<td>225</td>
<td></td>
</tr>
<tr>
<td>Foreword</td>
<td>226</td>
<td></td>
</tr>
<tr>
<td>Sections</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.0 Scope</td>
<td>227</td>
<td></td>
</tr>
<tr>
<td>2.0 Purpose</td>
<td>227</td>
<td></td>
</tr>
<tr>
<td>3.0 Definitions</td>
<td>227</td>
<td></td>
</tr>
<tr>
<td>3.1 Description of Testing Apparatus</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4.0 Base Cabinets</td>
<td>230</td>
<td></td>
</tr>
<tr>
<td>4.1 Description of Test Unit</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4.2 Cabinet Load Test</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4.3 Cabinet Concentrated Load Test</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4.4 Cabinet Torsion</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4.5 Cabinet Submersion Test</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4.6 Spill Containment Test</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5.0 Doors</td>
<td>233</td>
<td></td>
</tr>
<tr>
<td>5.1 Door Hinge Test</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5.2 Door Impact Test</td>
<td></td>
<td>Not applicable to Plastic Laminate Casework</td>
</tr>
<tr>
<td>5.3 Door Cycle Test</td>
<td>227</td>
<td></td>
</tr>
<tr>
<td>5.4 Door Cycle Test</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5.5 Drawer Static Test</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5.6 Drawer and Door Pull Test</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5.7 Drawer Impact Test</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5.8 Drawer Internal Impact Test</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5.9 Drawer Cycle Test</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6.0 Drawers</td>
<td>233</td>
<td></td>
</tr>
<tr>
<td>6.1 Drawer Static Test</td>
<td>230</td>
<td></td>
</tr>
<tr>
<td>6.2 Drawer and Door Pull Test</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6.3 Drawer Impact Test</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6.4 Drawer Internal Impact Test</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6.5 Drawer Cycle Test</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7.0 Shelving</td>
<td>235</td>
<td></td>
</tr>
<tr>
<td>7.1 Description of Test Unit</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7.2 Shelf Load Test</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
# Table of Contents (cont’d)

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>8.0 Cabinet Surface Finish Tests</strong></td>
<td></td>
</tr>
<tr>
<td><strong>8.1 Chemical Spot Test</strong></td>
<td>236</td>
</tr>
<tr>
<td>8.1.1 Purpose of Test</td>
<td></td>
</tr>
<tr>
<td>8.1.2 Test Procedure</td>
<td></td>
</tr>
<tr>
<td>8.1.3 Acceptance Level</td>
<td></td>
</tr>
<tr>
<td><strong>8.2 Boiling Water Test</strong></td>
<td></td>
</tr>
<tr>
<td>8.2.1 Purpose of Test</td>
<td></td>
</tr>
<tr>
<td>8.2.2 Test Procedure</td>
<td></td>
</tr>
<tr>
<td>8.2.3 Acceptance Level</td>
<td></td>
</tr>
<tr>
<td><strong>8.3 Ball Impact Test</strong></td>
<td></td>
</tr>
<tr>
<td>8.3.1 Purpose of Test</td>
<td></td>
</tr>
<tr>
<td>8.3.2 Test Procedure</td>
<td></td>
</tr>
<tr>
<td>8.3.3 Acceptance Level</td>
<td></td>
</tr>
<tr>
<td><strong>8.4 Paint Adhesion Test</strong></td>
<td></td>
</tr>
<tr>
<td>Not applicable to Plastic Laminate Casework</td>
<td></td>
</tr>
<tr>
<td><strong>8.5 Paint Hardness Test</strong></td>
<td></td>
</tr>
<tr>
<td>Not applicable to Plastic Laminate Casework</td>
<td></td>
</tr>
<tr>
<td><strong>8.6 Dart Impact Test</strong></td>
<td></td>
</tr>
<tr>
<td>8.6.1 Purpose of Test</td>
<td></td>
</tr>
<tr>
<td>8.6.2 Test Procedure</td>
<td></td>
</tr>
<tr>
<td>8.6.3 Acceptance Level</td>
<td></td>
</tr>
<tr>
<td><strong>8.7 Edge Delaminating Test</strong></td>
<td></td>
</tr>
<tr>
<td>8.7.1 Purpose of Test</td>
<td></td>
</tr>
<tr>
<td>8.7.2 Test Procedure</td>
<td></td>
</tr>
<tr>
<td>8.7.3 Acceptance Level</td>
<td></td>
</tr>
<tr>
<td><strong>8.8 Edge Impact Test</strong></td>
<td></td>
</tr>
<tr>
<td>8.8.1 Purpose of Test</td>
<td></td>
</tr>
<tr>
<td>8.8.2 Test Procedure</td>
<td></td>
</tr>
<tr>
<td>8.8.3 Acceptance Level</td>
<td></td>
</tr>
<tr>
<td><strong>8.9 Wear Resistance (Abrasion) Test</strong></td>
<td></td>
</tr>
<tr>
<td>8.9.1 Purpose of Test</td>
<td></td>
</tr>
<tr>
<td>8.9.2 Test Procedure</td>
<td></td>
</tr>
<tr>
<td>8.9.3 Acceptance Level</td>
<td></td>
</tr>
<tr>
<td><strong>9.0 Wall Cabinets, Counter Mounted and Tall Units</strong></td>
<td>239</td>
</tr>
<tr>
<td><strong>9.1 Description of Test Unit</strong></td>
<td></td>
</tr>
<tr>
<td><strong>9.2 Load Test</strong></td>
<td></td>
</tr>
<tr>
<td>9.2.1 Purpose of Test</td>
<td></td>
</tr>
<tr>
<td>9.2.2 Test Procedure</td>
<td></td>
</tr>
<tr>
<td>9.2.3 Acceptance Level</td>
<td></td>
</tr>
<tr>
<td><strong>10.0 Tables</strong></td>
<td>240</td>
</tr>
<tr>
<td><strong>10.1 Description of Test Unit</strong></td>
<td></td>
</tr>
<tr>
<td><strong>10.2 Load Test</strong></td>
<td></td>
</tr>
<tr>
<td>10.2.1 Purpose of Test</td>
<td></td>
</tr>
<tr>
<td>10.2.2 Test Procedure</td>
<td></td>
</tr>
<tr>
<td>10.2.3 Acceptance Level</td>
<td></td>
</tr>
<tr>
<td><strong>10.3 Table Racking</strong></td>
<td></td>
</tr>
<tr>
<td>10.3.1 Purpose of Test</td>
<td></td>
</tr>
<tr>
<td>10.3.2 Test Procedure</td>
<td></td>
</tr>
<tr>
<td>10.3.3 Acceptance Level</td>
<td></td>
</tr>
<tr>
<td><strong>Forms</strong></td>
<td>242</td>
</tr>
</tbody>
</table>

---

SEFA 8-PL Committee Members

Committee Co-Chairs

Kevin Krenzke - Bostontec Div of Case Systems
Kevin Kovash - TMI Systems Corporation
Foreword

SEFA Profile

The Scientific Equipment and Furniture Association (SEFA) is an international trade association comprised of manufacturers of laboratory furniture, casework, fume hoods and members of the design and installation professions. The Association was founded to promote this rapidly expanding industry and improve the quality, safety and timely completion of laboratory facilities in accordance with customer requirements.

SEFA Recommended Practices

SEFA and its committees are active in the development and promotion of Recommended Practices having domestic and international applications. Recommended Practices are developed by the association taking into account the work of other standard writing organizations. Liaison is also maintained with government agencies in the development of their specifications.

SEFA's Recommended Practices are developed in and for the public interest. These practices are designed to promote a better understanding between designers, architects, manufacturers, purchasers, and end-users and to assist the purchaser in selecting and specifying the proper product to meet the user's particular needs. SEFA's Recommended Practices are periodically updated. The Recommended Practices are numbered to include an annual suffix which reflects the year that they were updated. SEFA encourages architects to specify these Recommended Practices as follows: “SEFA 8-PL-2016”.

SEFA Glossary of Terms

SEFA has developed a Glossary of Terms (SEFA 4-2010) for the purpose of promoting a greater understanding between designers, architects, manufacturers, purchasers and end users. The terms defined by SEFA are frequently used in contracts and other documents, which attempt to define the products to be furnished or the work involved. The Association has approved this Glossary in an effort to provide uniformity among those who use these terms. Where a specific Recommended Practice contains definitions which differ from those in the Glossary of Terms, then the definitions in the specific Recommended Practice should be used.

SEFA encourages all interested parties to submit additional terms or to suggest any changes to those terms already defined by the Association. The definitions should be used to help resolve any disputes that may arise or to incorporate the applicable terms in any contract or related documents.

SEFA Disclaimer

SEFA uses its best effort to promulgate Recommended Practices for the benefit of the public in light of available information and accepted industry practices. SEFA does not guarantee, certify or assure the safety or performance of any products, components, or systems tested, installed, or operated in accordance with SEFA Recommended Practices or that any tests conducted under its Recommended Practices will be non-hazardous or free from risk. SEFA encourages the use of third party independent testing where appropriate.

Note: Testing as described in this document must be performed and documented by a SEFA-approved third party testing facility. See Page 34 of the SEFA Desk Reference 5th Edition Version 2.0, or visit us at SEFALABS.COM for the most current list of SEFA-approved test labs.
1.0 Scope

The scope of this document is intended to provide manufacturers, specifiers, and users tools for evaluating the safety, durability, and structural integrity of plastic laminate laboratory grade furniture and complimentary items. This document is inclusive of casework (base units, wall mounted units, counter mounted units, tall units, tables and, shelving systems). Casework, tables, and shelving manufactured for laboratory use should be subjected to the tests and procedures outlined below.

Plastic laminate laboratory grade casework shall consist of base cabinets, wall cabinets, counter mounted cabinets, tall cabinets, tables, and shelving and shall be constructed of a core, high pressure laminate, backer, liner or thermally fused melamine. A plastic laminate cabinet consists of top, bottom, end members and a back. Aggregate test results may vary by manufacturer. Procedures for testing performance criteria shall be as outlined in this document and results made available upon request. It is assumed that the test model reflects the performance criteria for all products. However there may be certain door/drawer configurations and/or sizes outside the test unit configuration identified that may not meet certain parts of this test. A test unit has been identified in this document with the sole purpose of obtaining continuity for procedures and results in a scientific format.

Great care should be exercised when heavy loads are applied to the cabinet and appropriate safety precautions taken to insure safety of testing personnel. Properly trained personnel should perform all tests. SEFA assumes no liability for damage or injury as a result of conducting these tests.

The acceptance levels are based on the cumulative field experience and laboratory testing of SEFA members based on actual needs of laboratories. This is a performance-based document. Specifications proscribing specific materials, hardware, finishes, workmanship or construction may or may not meet acceptance levels of this document. If proscriptive components of the specifications conflict with compliance of this document then the Architectural proscribed elements take precedent.

Testing as outlined in this document must be performed and documented by a SEFA-approved independent third party testing facility.

2.0 Purpose

The purpose of this document is to describe the distinguishing performance characteristics of plastic laminate laboratory grade furniture and complimentary items. Furniture shall be of a type specifically designed and manufactured for installation and use in a laboratory.

Although aggregate test results may vary from manufacturer to manufacturer, procedures for testing performance criteria shall be as outlined in this document and results made available upon request. It is assumed that the test model reflects the performance criteria for all products regardless of construction, size, or style used. A test unit has been identified in this document with the sole purpose of obtaining continuity for procedures and results in a scientific format.

3.0 Definitions

Acceptance Levels - The acceptance level for each performance criteria is based on the cumulative experience of actual field testing and laboratory results of SEFA members. Acceptance levels describe the expected outcome of each test procedure.

ANSI/BIFMA - ANSI is the American National Standards Institute. Approval of an American National Standard requires verification by ANSI that the requirements for due process, consensus, and other criteria for approval have been met by the standards developer. BIFMA is the Business and Institutional Furniture Manufacturer’s Association, an association of manufacturers of desk products and the like.

Apparatus - A machine or group of machines and accessories.
Arithmetic Mean - A number obtained by dividing the sum of a set of quantities by the number of quantities in a set; average.


Base Cabinets - A base cabinet is a storage devise consisting of two ends, a back, a face and may or may not include a top or top frame. The face may be open, to access the storage area, or may be outfitted with one or more drawers and/or doors. A base cabinet is always placed on the floor and normally supports a surface. The top sur-face is normally no more than 42” (1,067mm) off the floor surface.

Best Practices - When given a choice of grade, the “best practice” is to select one that offers a well defined degree of control over the quality of workmanship, materials, and installation of a project. SEFA-8 Recommended Practices are written from a view of high quality laboratory furniture.

Cabinet Depth (Deep) - Given a front, bottom, two sides, and a top, the cabinet depth is a measure of the side of the cabinet, in its normal upright position, from the outside back to the outside front excluding doors and door fronts.

Cabinet Height (High) - Given a front, bottom, two sides, and a top, the cabinet height is a measure of the side of the cabinet, in its normal upright position, from the bottom edge of the side to the top, excluding any surface.

Cabinet Width (Wide) - Given a front, bottom, two sides, and a top, the cabinet width is a measure of the front of the cabinet in its normal upright position from one side to the other.

Casework - Base and wall cabinets, display fixtures, and storage shelves. The generic term for both “boxes” and special desks, reception counters, nurses stations and the like. Generally includes the tops and work surfaces.

Chase (Plumbing Area) - Space located behind the back of the base cabinet used to house plumbing or electric lines.

Composition Core - A core material using particleboard, MDF, or agrifiber product.

Combination Unit - A base unit of the type that has both door(s) and drawer(s).

Counter Mounted Cabinet - A counter mounted cabinet is a wall cabinet (usually with a height of approximately 48” [1,219mm] and is typically mounted on the work surface or shelf, as in a reagent shelf).

Cupboard (Door Unit) - That portion of the cabinet with no drawer(s) that may be enclosed by doors.

Drawer - A sliding storage box or receptacle opened by pulling out and closed by pushing in.

Edge - Material of varying thickness commonly used to provide protection and seal the machine edge(s) of laminated panels. Typical edge materials are ABS, PVC, self-edge, or wood.

Free Standing - Requiring no support or fastening to other structures.

Hardware - Items such as screws, pulls, hinges, latches, locks, and drawer slides used in the construction of casework.

Joinery – The junction of two pieces intended to be permanently connected.

Laboratory Furniture - Furniture designed and manufactured for installation and use in a laboratory.

Latch - A piece of hardware designed to hold a door closed.

Leveling Screws (Levelers) - Threaded components designed to allow adjustment of the cabinet vertically as needed for leveling.

Medium Density Fiberboard (MDF) - Wood particles reduced to fibers in a moderate pressure steam vessel combined with a resin, and bonded together under heat and pressure.

Nominal Dimensions - Not all cabinet manufacturers produce product to the identical dimensions. All dimensions given in this
document are accurate to within five percent, which is considered nominal.

**Particleboard** - A panel or core product composed of small particles of wood and wood fiber that are bonded together with synthetic resin adhesives in the presence of heat and pressure.

**Permanent Damage** - Destruction to material or joinery that would require repair in order to return to its original state.

**Permanent Deformation** - Deflection that has exceeded the limits of the product, thus changing the original shape of the product.

**Permanent Deterioration** - Erosion or corrosion of material such that the component will never return to its original shape.

**Permanent Failure** - See “permanent damage.”

**Plywood** - The term plywood is defined as a panel manufactured of three or more layers (plies) of wood or wood products (veneers or overlays and/or core materials), generally laminated into a single sheet (panel). Plywood is separated into two groups according to materials and manufacturing, hardwood plywood and softwood plywood. Except for special constructions, the grain of alternate plies is at right angles.

**Pulls** - Articles of hardware used to grasp and open/close the door or drawer (see also hardware).

**Rack Resistance** - The ability of a product to resist stresses that tend to make the product distort and the drawers to become misaligned.

**Rail** - A horizontal member extending from one side of the cabinet to the other.

**Reagent** - A substance used because of its chemical or biological activity.

**Removable Back** - A panel located on the inside back of the base cabinet, which is removable in order to gain access to utilities.

**Stainless Steel** - Iron based alloys containing more chromium than the 12% necessary to produce passivity (less reactive), but less than 30%.

**Submersion** - Covered with water.

**Tables** – An article of furniture having a flat, horizontal surface supported by one or more support members (legs), and a frame (apron).

**Tall Cabinet (Full Height Unit)** - A tall cabinet is a storage device that consists of two ends, a top and bottom panel, a back and a face. The face may be open to access the storage area or may be outfitted with one or more drawers and/or door(s). A tall cabinet is always placed on the floor and is nominally 84” (2,134mm) high.

**Torsion** – A force acting at a distance which tends to twist or rotate an object or cabinet.

**Uniformly Distributed** – A force applied evenly over the area of a surface.

**Unobstructed Entry** - A cabinet is deemed to be unobstructed if access to the entire storage area is completely without obstacle.

**Upright Position** - A cabinet oriented in its intended position.

**Veneer Core Plywood** – A panel or core product composed of an odd number of thin veneer layers that are bonded together with an adhesive. Except for special constructions, the grain of alternate plies is at right angles. All plies shall be combinations of species, thickness, density, and moisture content to produce a balanced panel. All inner plies, except the innermost ply, shall occur in pairs.

**Wall Cabinet** - A wall cabinet is a storage device consisting of two ends, a back, a top, bottom, and a face. The face may be open to access the storage area or may be outfitted with one or more door(s). The wall cabinet usually does not include a drawer. A wall cabinet is always mounted on a vertical surface such as a wall, a divider, panel or some other vertical structure. A wall cabinet is usually less than 48” (1,219mm) high.

**Work Surface** - A normally horizontal surface used to support apparatus at a convenient height.
above the floor. Work surfaces are normally positioned atop a base cabinet or table structure.

### 3.1 Description of Testing Apparatus

Solid Steel Bar - A square solid steel bar 2 1/2” (63mm) square, 28 1/4” (717mm) long, weighing 50 pounds (22.679 Kg).

Sand or Shot Bag (10 pounds [4.535 Kg]) - A bag of plastic or cloth with the approximate dimensions 10 9/16” (268mm) x 11” (279mm) as in typical “gallon size re-closable storage bags.” Filled with enough sand or shot so that contents weigh 10 pounds (4.535 Kg).

Sand Bag (20 pounds [9.071 Kg]) - Two 10 pound (4.535 Kg) sand bags bound together.

Shot Bag (100 lbs. [45.359 Kg]) - A plastic or cloth bag of sufficient size to contain 100 pounds (45.359 Kg) of shot.

Cycling Mechanism - Per ANSI BHMA 156.9.-2003

Steel Rod - A 2” (51mm) diameter by 12” (305mm) long rod, approximately 10 pounds (4.535 Kg) in weight.

Hardwood Corner Block - A block of hardwood 2” (51mm) square by 1” (25.4mm) high.

Edge Delamination test stand – The sample per section 8.7, Figure 8, is to be clamped into a base stand by the core material that the edgeband is glued to. The Instron force gauge (or equivalent type of force gauge) is mounted in a manner above the sample to pull vertically upward on the edgeband per Figure 9.

Edge Impact test stand – Please refer to Section 8.8, Figures 10 and 11, for dimensional information on the critical sizes that are to be used. The test stand is to be mounted to a stable vertical surface (large test stand frame or building wall) that will not allow impact absorption. The 22.75” hinged arm is 1” square, 14 ga tubing with a .75” x 2” x 10” solid steel bar attached to the end portion. The arm is hinged to the top extension of the base plate. The 9.5” square test sample is bolted to the test base plate as shown in figure #10 using a piece of metal angle above and below the sample. Bolts are run through both top and bottom angles and the test sample and securely tightened.

### 4.0 Base Cabinets

#### 4.1 Description of Test Cabinet

The base cabinet shall be a combination of cupboard and drawer per Figure 1. The base cabinet shall be 48” +/- 1” (1219.2mm +/- 25.4mm) wide, 36” +/- 1” (914.4mm +/- 25.4mm) high, and 22” +/- 1” (558 mm +/- 25.4mm) deep. Cabinet dimensions do not include drawer or door front thickness. The drawer shall be above the cupboard, full width and approximately one-fourth the height of the cabinet’s face opening. Drawer shall be a minimum of 18” (457.2mm) deep outside dimension. When slides are used for drawers, slides shall be a minimum of 18” (457.2mm) deep. Cupboard shall be double-door design and provide unobstructed entry into the cabinet interior with the doors open. The unit shall contain one adjustable shelf. The cabinet back shall be the removable type (per manufactures standard design as used for access to the plumbing or chase area) with the removable panel removed. Removable panel to be a minimum 36” x 18” (914.4mm x 457.2mm). The cabinet shall have full height end panels with integral toeboard. The cabinet shall be free standing, squared and sitting 1” (25.4mm) off the floor atop four hardwood corner blocks 2” (50.8mm) square and 1” (25.4mm) high. A top of 1” (25.4mm) thick 37-50 pcf medium density fiberboard shall be positioned on the cabinet without glue or
fasteners of any kind. The top dimensions will be such that it will overhang the cabinet perimeter by 1” (25.4).

Before conducting the test, a visual examination shall be conducted to verify that the unit configuration and setup conditions are appropriate. Operate doors and drawer. Doors should be free moving and latch properly. Inspect the unit for dimensions and note the fit of doors and drawers to the cabinet body. Open and close the drawer. The drawer should be free moving and function as specified by the manufacturer. Discontinue evaluation if unit is not in compliance or if malfunction is noted.

Although aggregate test results may vary from manufacturer to manufacturer, procedures for testing performance criteria shall be as outlined in this document and results made available upon request. It is assumed that the test model reflects the performance criteria for all products regardless of construction, size, or style used. A test unit has been identified in this document with the sole purpose of obtaining continuity of procedures and results in a scientific format.

4.2 Cabinet Load Test

4.2.1 Purpose of Test

The cabinet load test will challenge the structural integrity and load bearing capability of the cabinet construction. Regardless of countertop selection or attachment of cabinet to wall or floor, this test will demonstrate the ability of the cabinet to support heavy applied loads. This is not intended to test the functional characteristics of the cabinet under heavy loads.

4.2.2 Test Procedure

Verify that the cabinet is level. Remove drawer and open doors for testing purpose. Load the cabinet top by using 2000 pounds (907.184 Kg) of solid steel bars (per Section 3.1) stacked four high and spaced per Figure 2. After 24 hours, unload the cabinet.

4.2.3 Acceptance Level

The cabinet will have no permanent failure.

4.3 Cabinet Concentrated Load Test

4.3.1 Purpose of Test

The purpose of this test is to challenge the functional characteristics of the cabinet when subjected to a concentrated load on the center of the cabinet top.

4.3.2 Test Procedure

Using solid weights or 10 pound (4.535 Kg) sand bags (per Section 3.1), apply a total of 200 pounds (90.718 Kg) to the top of the cabinet along the cabinet centerline (see Figure 3). Operate doors and drawers.

4.3.3 Acceptance Level

Under condition of test load, doors and drawer shall operate normally. There shall be no permanent damage.
permanent distortion to front rail, cabinet joinery, doors, or drawers.

4.4 Cabinet Torsion Test

4.4.1 Purpose of Test

This test will evaluate the structural integrity of the cabinet construction when subjected to a torsional load.

4.4.2 Test Procedure

The cabinet shall be tested in its normal upright position, raised not less than four-inches off the floor and supported on rear and one front corner. The area of support under the cabinet shall be located not more than 6’ (152.4mm) in from each supported corner. Secure the cabinet diagonally from the unsupported corner with seven solid steel bars per Section 3.1 (350 pounds (158.757 Kg) of weight), on the top of the cabinet to prevent overturning. Apply four solid steel bars (200 pounds [90.718 Kg] of weight) to the unsupported corner for a period of 24 hours (see Figure 4). Remove weight and place cabinet on the floor in its normal upright position. Observe cabinet joinery. Level the cabinet and measure the face and back of the cabinet across the diagonal corners.

4.4.3 Acceptance Level

When returned to normal position, the operation of the cabinet shall be normal, and there will be no permanent damage. The difference between the two measurements taken from measuring the diagonal corners shall be no more than 1/8” (3.175mm).

4.5 Cabinet Submersion Test

There are numerous options for removable bases or ladder type bases with plastic laminate casework, including exterior grade plywood, MR board, composites, etc. Standard 1-M-2 and 1-M-3 particleboard is not recommended for sub-base material if there is a possibility of standing water as an issue.

4.5.1 Purpose of Test

This test will demonstrate the ability of a cabinet to resist wicking of moisture from the floor. Only units that rest on the floor or a unit where the base is within 2” (50.8 mm) of the floor should be subjected to this test.

4.5.2 Test Procedure

The material thickness along the perimeter of the cabinet shall be measured at 6” (152.4mm) increments. Record the thickness of the material to be submerged in water. Calculate the arithmetic mean of the data taken. Place the entire test cabinet in its upright position such that the cabinet is submerged 2” above the bottom of the removable base. Cabinet doors are removed for this test. After 24 hours, remove the unit from the water. After 48 hours of drying time, measure the thickness of the material at the same points measured initially. Calculate the new arithmetic mean. After the unit has been allowed to dry, inspect for other damage.

4.5.3 Acceptance Level

The cabinet will show no permanent deformation or deterioration. Increase in thickness shall not exceed ten percent of the initial mean measurements.

4.6 Spill Containment Test

Not applicable to Plastic Laminate Casework.
5.0 Doors

5.1 Door Hinge Test

5.1.1 Purpose of Test

This test will demonstrate the durability of the door, door attachment and its hardware (hinge leaf, screws, etc.) to an applied load of 160 pounds (72.575 Kg).

5.1.2 Test Procedure

Remove the shelf for this test. With unit and top set as described in Section 4.1, add sufficient weight to the top in order to prevent overturning. With cabinet door opened 90-degrees, hang a sling made up of two 80 pound (45.359 Kg) weights (shot bags or solid weights) over top of the door at a point 12" (304.8mm) from the hinge centerline (see Figure 5). Slowly move door through two full cycles of the hinge at 160-degree arc. Remove weight and swing door through its full intended range of motion and close door.

5.1.3 Acceptance Level

The open door shall withstand a load of 160 pounds (72.575 Kg) when applied at a point 12" (304.8mm) from the hinge centerline without permanent damage. Operation of the door, after test shall show no significant permanent damage that will cause binding of the door or hinges or that will adversely affect operation of the catch.

5.2 Door Impact Test

Not applicable to Plastic Laminate Casework.

5.3 Door Cycle Test

5.3.1 Purpose of Test

This test will demonstrate the durability of the door hinge hardware to withstand 100,000 cycles as a reliable measure for longevity).

5.3.2 Test Procedure

This test shall be in conformance to the ANSI test procedure A156.9, Grade 1, requirements for cycle testing of doors. A cycling mechanism shall swing door 90-degrees. Door shall operate for 100,000 cycles with a speed not greater than 15 cycles per minute.

5.3.3 Acceptance Level

Door shall operate for the full cycle period without deterioration that will significantly affect the function of the door. The door shall operate freely without binding.

6.0 Drawers

6.1 Drawer Static Test

6.1.1 Purpose of Test

This test will demonstrate the ability to support a point load given to the front of the drawer and will challenge the drawer suspension system and the attachment of the drawer head to the drawer.

6.1.2 Test Procedure

With unit and top set as described in Section 4.1, add sufficient weight to the top in order to
prevent overturning. Open the drawer to 13” (330.2mm) of travel and hang 150 pounds (68.03 Kg) from the drawer head at the centerline of the drawer for five minutes. Remove the weight and operate the drawer through the full cycle.

6.1.3 Acceptance Level

There shall be no interference with the normal operation of the drawer and the drawer head should remain tightly fastened to the drawer.

Fig. 6 Base Cabinet Drawer Static Load Test Configuration

6.2 Drawer and Door Pull Test

Not Applicable to Plastic Laminate Casework.

6.3 Drawer Impact Test

6.3.1 Purpose of Test

This test will demonstrate the resistance to impact of the drawer bottom.

6.3.2 Test Procedure

Remove drawer; support each corner with 2”x2”x1” (50.8 x 50.8 x 25.4 mm) supports. Drop a 10 pound (4.545 Kg) sand or shot bag from a height of 24” (609.6 mm) into the bottom of the drawer at the center of the width of the drawer. Remove the sand or shot bag.

6.3.3 Acceptance Level

No damage or breakout of the drawer bottom.

6.4 Drawer Internal Rolling Impact Test

6.4.1 Purpose of Test

This test will evaluate the strength of the drawer head, bottom, and back as a result of opening and closing the drawer with a rolling load.

6.4.2 Test Procedure

Position the drawer on a table at a 45-degree angle per Figure 7. Place a 2” (50.8mm) diameter by 12” (304.8mm) long steel rod (approximately 10 pounds (4.545 Kg)) 13” (330.2mm) from the target impact area such that the rod will roll freely to impact the back of the drawer. Subject the back to three impacts and reverse the drawer to subject the front to three additional impacts.

Fig. 7 Base Cabinet Drawer Internal Rolling Impact Test Configuration

6.4.3 Acceptance Level

The drawer shall show no permanent damage. All joinery shall be intact and the drawer, when replaced in the unit, shall operate normally. Minor scratches and dents are acceptable.
6.5 **Drawer Cycle Test**

6.5.1 **Purpose of Test**

This test is intended to test the drawer’s operation under full load. To be considered Laboratory Grade Plastic Laminate Casework, the mechanical drawer slides must be rated at a minimum, ANSI/BHMA A156.9 Grade 1.

6.5.2 **Test Procedure**

Mechanical Suspension Systems – A dynamic load of 100 pounds (45.359 Kg) shall be uniformly distributed in the drawer. Measure force required to activate the drawer. Operate over the full range of motion without engaging bumpers, stops or self-closing features for 50,000 cycles at a rate not to exceed 8 - 12 cycles per minute.

6.5.3 **Acceptance Level**

The drawer shall operate freely without evidence of binding. The force required to open and close loaded drawer shall not be greater than 8 pounds to activate.*

---

*The American’s with Disabilities Act (ADA) requires a force no greater than five pounds to activate hardware. The load rating in this document is intended only for testing conditions where loads challenge the durability of the hardware. Under actual conditions, drawer loading should be reduced to levels that result in compliance with ADA as applicable.

7.0 **Shelving**

7.1 **Description of Test Cabinet**

Plastic Laminate shelving shall be tested using the following procedure. The shelves to be tested are as described in Sections 4.1 and 9.1 “Description of Test Cabinet”.

7.2 **Shelf Load Test**

7.2.1 **Purpose of Test**

This test will demonstrate the ability of a shelf and its mounting hardware to support loads of 40 pounds (18.143 Kg) per square foot, not to exceed 200 pounds (90.718 Kg).

7.2.2 **Test Procedure**

A shelf shall be mounted in a manner in which it is designed. Measure the distance from the underside of the shelf to a reference point perpendicular to the center of the shelf. Use shot or sand bags weighing 10 pounds (4.535 Kg) each. Unless otherwise specified, load the shelf uniformly to 40 pounds (18.14 kg) per square foot of shelf area to a maximum of 200 pounds (90.71 Kg). Measure the deflection of the shelf by measuring the distance to the reference point and calculating the difference between the two measurements. Record data and remove the load from the shelf.

7.2.3 **Acceptance Level**

Different materials will perform differently to the loads based on the Modulus of Elasticity of the material and the cross section moment of inertia for the shape of the material. Longer shelves will support less loads than shorter shelves. The allowable maximum deflection of a shelf is 1/180 of the span and not in excess of .25” (6.35mm).
8.0 Cabinet Surface Finish Tests

8.1 Chemical Spot Test

Users should consider the chemical and staining agents that might be used near the laboratory casework. Common guidelines can be found by referring to: The casework manufacturer printed data for chemical and stain resistance, NEMA LD3-2000 for wood product chemical resistance, ASTM D3023 and ASTM C1378 for stain resistance or the most current versions. Because chemical and stain resistance is affected by concentration, time, temperature, humidity, housekeeping and other factors, it is recommended that users test samples in their actual environment with the substances they use.

8.1.1 Purpose of Test

The purpose of the chemical spot test is to evaluate the resistance a finish has to chemical spills.

Note: Many organic solvents are suspected carcinogens, toxic and/or flammable. Great care should be exercised to protect personnel and the environment from exposure to harmful levels of these materials.

8.1.2 Test Procedure

Obtain one sample panel measuring 14” x 24” (355.6mm x 609.6mm). The received sample to be tested for chemical resistance as described herein.

Place panel on a flat surface, clean with soap and water and blot dry. Condition the panel for 48-hours at 73º +/- 3ºF (23º +/- 2ºC) and 50 +/- 5% relative humidity or the currently accepted guideline set by ASTM. Test the panel for chemical resistance using forty-nine different chemical reagents by one of the following methods.

Method A - Test volatile chemicals by placing a cotton ball saturated with reagent in the mouth of a 1-oz. (29.574cc) bottle and inverting the bottle on the surface of the panel.

Method B - Test non-volatile chemicals by placing five drops of the reagent on the surface of the panel and covering with a 24mm watch glass, convex side down.

For both of the above methods, leave the reagents on the panel for a period of one hour. Wash off the panel with water, clean with detergent and naptha, and rinse with deionized water. Dry with a towel and evaluate after 24-hours at 73º +/- 3ºF (23º +/- 2ºC) and 50 +/- 5% relative humidity, or the currently accepted guideline set by ASTM using the following rating system.

Level 0 - No detectable change.
Level 1 - Slight change in color or gloss.
Level 2 - Slight surface etching or severe staining.
Level 3 - Pitting, cratering, swelling, or erosion of coating. Obvious and significant deterioration.

Note: Percentages are by volume.

8.1.3 Acceptance Level

Range of results is provided to establish the acceptable range for a Laboratory Grade Finish. Results will vary from manufacturer to manufacturer due to differences in finish formulations. Laboratory grade finishes shall result in no more than four (4) Level 3 conditions. Individual test results, for the specified 49 reagents, will be verified with the established third party, independent SEFA 8 test submittal form. Suitability for a given application is dependent upon the chemicals used in a given laboratory.
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Acetate, Amyl</td>
<td>A</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>2</td>
<td>Acetate, Ethyl</td>
<td>A</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>3</td>
<td>Acetic Acid, 98%</td>
<td>B</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>4</td>
<td>Acetone</td>
<td>A</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>5</td>
<td>Acid Dichromate, 5%</td>
<td>B</td>
<td>2</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>6</td>
<td>Alcohol, Butyl</td>
<td>A</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>7</td>
<td>Alcohol, Ethyl</td>
<td>A</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>8</td>
<td>Alcohol, Methyl</td>
<td>A</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>9</td>
<td>Ammonium Hydroxide, 28%</td>
<td>B</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>10</td>
<td>Benzene</td>
<td>A</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>11</td>
<td>Carbon Tetrachloride</td>
<td>A</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>12</td>
<td>Chloroform</td>
<td>A</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>13</td>
<td>Chromic Acid, 60%</td>
<td>B</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>14</td>
<td>Cresol</td>
<td>A</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>15</td>
<td>Dichloroacetic Acid</td>
<td>A</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>16</td>
<td>Dimethylformamide</td>
<td>A</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>17</td>
<td>Dioxane</td>
<td>A</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>18</td>
<td>Ethyl Ether</td>
<td>A</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>19</td>
<td>Formaldehyde, 37%</td>
<td>A</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>20</td>
<td>Formic Acid, 90%</td>
<td>B</td>
<td>2</td>
<td>2</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>21</td>
<td>Furfural</td>
<td>A</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>22</td>
<td>Gasoline</td>
<td>A</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>23</td>
<td>Hydrofluoric Acid, 37%</td>
<td>B</td>
<td>2</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>24</td>
<td>Hydrofluoric Acid, 48%</td>
<td>B</td>
<td>2</td>
<td>3</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>25</td>
<td>Hydrogen Peroxide, 30%</td>
<td>B</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>26</td>
<td>Iodine, Tincture of</td>
<td>B</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>27</td>
<td>Methyl Ethyl Ketone</td>
<td>A</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>28</td>
<td>Methylenyl Chloride</td>
<td>A</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>29</td>
<td>Mono Chlorobenzene</td>
<td>A</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>30</td>
<td>Naphthalene</td>
<td>A</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>31</td>
<td>Nitric Acid, 20%</td>
<td>B</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>32</td>
<td>Nitric Acid, 30%</td>
<td>B</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td>2</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>33</td>
<td>Nitric Acid, 70%</td>
<td>B</td>
<td>2</td>
<td>3</td>
<td>2</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>34</td>
<td>Phenol, 90%</td>
<td>A</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>35</td>
<td>Phosphoric Acid, 85%</td>
<td>B</td>
<td>2</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>36</td>
<td>Silver Nitrate Saturated</td>
<td>B</td>
<td>0</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>37</td>
<td>Sodium Hydroxide 10%</td>
<td>B</td>
<td>1</td>
<td>0</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>38</td>
<td>Sodium Hydroxide 20%</td>
<td>B</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>39</td>
<td>Sodium Hydroxide 40%</td>
<td>B</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>40</td>
<td>Sodium Hydroxide Flake</td>
<td>B</td>
<td>0</td>
<td>0</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>41</td>
<td>Sodium Sulfide Saturated</td>
<td>B</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>42</td>
<td>Sulfuric Acid, 33%</td>
<td>B</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>43</td>
<td>Sulfuric Acid, 77%</td>
<td>B</td>
<td>1</td>
<td>3</td>
<td>2</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>44</td>
<td>Sulfuric Acid, 96%</td>
<td>B</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>45</td>
<td>Sulfuric Acid 77% &amp; Nitric Acid 70% equal parts</td>
<td>B</td>
<td>2</td>
<td>3</td>
<td>0</td>
<td>1</td>
<td>3</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>46</td>
<td>Toluene</td>
<td>A</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>47</td>
<td>Trichloroethylene</td>
<td>A</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>48</td>
<td>Xylene</td>
<td>A</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>49</td>
<td>Zinc Chloride, Saturated</td>
<td>B</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>
8.2 Boiling Water Resistance Test

8.2.1 Purpose of Test

The purpose of this test is to measure the ability of high-pressure laminate to maintain its color and surface finish when subjected to boiling water.

8.2.2 Test Procedure

This test procedure is outlined in ANSI/NEMA LD 3-2005 Para 3.5 Boiling Water Resistance.

8.2.3 Acceptance Level

Acceptance level as defined in ANSI/NEMA LD 3-2005 Para 3.5 Boiling Water Resistance. No effect - no change in color or surface finish.

8.3 Ball Impact Resistance Test

8.3.1 Purpose of Test

The purpose of this test is to measure the ability of high-pressure laminate to resist fractures due to impact by a large diameter ball.

8.3.2 Test Procedure

This test procedure is outlined in ANSI/NEMA LD 3-2005 Para 3.8 Ball Impact Resistance.

8.3.3 Acceptance Level

Acceptance level as defined in ANSI/NEMA LD 3-2005 Para 3.8 Ball Impact Resistance. The report shall indicate the actual height of impact resistance. Minimum of 50” (1250mm)

8.4 Paint Adhesion Test

Not Applicable to Plastic Laminate Casework.

8.5 Paint Hardness Test

Not Applicable to Plastic Laminate Casework.

8.6 Dart Impact Test

8.6.1 Purpose of Test

The purpose of the test is to measure the ability of high-pressure laminate to resist fracture due to a small diameter ball.

8.6.2 Test Procedure

Per ANSI/NEMA LD 3-2005 Para 3.9.

8.6.3 Acceptance Level

Per ANSI/NEMA LD 3-2005 Para 3.9. The impact resistance value shall be reported in millimeters. Minimum of 500mm (20”).

8.7 Edge Delaminating Test

8.7.1 Purpose of Test

The purpose of this test is to evaluate the adhesion strength between the edge and the core material.

8.7.2 Test Procedure

Mount test specimens in Instron force gauge jaws to pull the edge close to 90 degrees to the bond line of the banding, this angle may be varied based on the flexibility of the edge material. Measure the force required to separate the edge from the specimen. 2-inch x 6-inch panels with 13-inch edge banding, see Figures 8 and 9.

Figure 8 - Edge Delaminating Test Specimen

Figure 9 Edge Delaminating Test and Setup
8.7.3 Acceptance Level

Peel value must be greater than 18.5 lbs/in.

8.8 Edge Impact Test

8.8.1 Purpose of Test

The purpose of this test is to demonstrate the resilience of the 3 mm PVC edge band material.

8.8.2 Test Procedure

Insert test specimen with 3mm edge band facing the front into fixture, raise arm to stop, release arm and let it impact the sample one time. See Figures 10 & 11.

8.8.3 Acceptance Level

There shall be no signs of damage to the 3 mm edge banding that was applied to the test specimen.

8.9 Wear Resistance (Abrasion) Test

8.9.1 Purpose of Test

This Test measures the ability of high-pressure laminate to resist abrasive wear-through of the decorative layer.

8.9.2 Test Procedure


8.9.3 Acceptance Level


9.0 Wall, Counter Mounted and Tall Units

9.1 Description of Test Cabinet

Evaluation shall be conducted on a wall mounted cabinet with nominal dimensions as follows: 48” (1,219.2mm) +/- 1” wide, 30” (762mm) +/- 1” high, and 12” (304.8mm) +/- 1” deep. The wall cabinet shall be manufactured to manufacturers’ standard construction and practices. The wall cabinet shall have two (2) doors and two (2) shelves. Shelves shall be evaluated per Section 7.0 (Shelving). The unit and shelves shall be mounted in a manner recommended by the manufacturer. A visual examination shall be conducted to verify that the configuration and installation comply with these conditions. Discontinue evaluation if unit is not in compliance or if malfunction is noted.
9.2 Wall Cabinet Load Test

9.2.1 Purpose of Test

The wall mounted load test will demonstrate the strength of the back of the wall cabinet as well as the joinery of the cabinet and function of doors when the unit is subjected to loads normally expected for laboratory furniture.

9.2.2 Test Procedure

Using sand or shot bags weighing 10 pounds (4.55 Kg) each, load cabinet bottom, each shelf, and top uniformly with 40 pounds (18.18 Kg) per square foot to a maximum of 200 pounds (90.91 Kg) each. Maximum load to any cabinet shall not exceed 600 pounds (272.73 Kg) (a maximum of 200 pounds [90.91 Kg] loaded to each bottom, a minimum of one shelf loaded per Section 7.0, and the top) regardless of the number of shelves. Test to be performed with doors closed.

9.2.3 Acceptance Level

With weights in place, after a period of 24 hours, operate doors through full travel to verify normal operation of doors. Remove weights and operate doors to verify normal operation. Verify that there is no significant permanent deflection of cabinet top, cabinet back, cabinet bottom, or shelves. After weights are removed, the cabinet shall show no permanent damage to the cabinet, cabinet bottom, or shelves.

10.0 Tables

10.1 Description of Test Unit

The table for evaluation shall be a standing height, four legged, freestanding table. The table shall be nominally 60" (1,524mm) long, 24" (609.6mm) deep, and 36" (914.4mm) high (see Figure 13). Leg and apron size and construction shall be to manufacturer's specification. A top of 1" (25.4mm) thick 37 - 50 pcf medium density fiberboard shall be mounted on the table in the manner recommended by the manufacturer. The top dimensions will be such that it will overhang the cabinet perimeter by 1". Its weight shall be included in the test as live load.

A very large range of styles and designs can represent tables. Products inclusive in this section of testing are: Free Standing Tables, Desks, Aprons mounted between two fixed areas such as a wall or Casework, Mobile Tables (Free Standing Tables on wheels or casters), Mobile Under Counter Units, Mobile Workstations, Adjustable Tables, Modular Tables, C-Frame Tables, L-Frame Tables, J-Frame Tables, and Tables for systems furniture. These table systems can all be classified as one of three types of tables; Fixed, Free Standing, and mobile. See Figure 13.

10.2 Table Static Load

10.2.1 Purpose of Test

This test will challenge the table components to loads that are normal for use in a laboratory.

10.2.2 Test Procedure

Load the table top by using solid steel bars (per Section 3.1), each weighing 50 pounds (22.679 Kg), stacked evenly and spaced per Figure 14. Load the table to the manufacturer's recommended live load*. These evenly distributed loads should be no less than 300 pounds (136.077 Kg) for mobile, 600 pounds (272.155 Kg) for free standing and 2000 pounds (907.184 Kg) for fixed. Include the weight of the working surface as live load.

* Table load will vary considerably. Factors impacting live load capacity include the size of the table, material, amount of drawers and book compartments, glide or caster load rating. Contact manufacturer for live load specifications. See Fig 14.
10.2.3 Acceptance Level

No structural breakage shall result from application of the load. With the full load, the apron rails shall not deflect more than 1/360 of the span of the table and not to exceed 1/8" (3.175mm). In the case of a table with a drawer, the deflection of the rail shall not interfere with the function of the drawer. After the load is removed, inspect the table for structural damage.

10.3 Table Racking

10.3.1 Purpose of Test

This test will demonstrate the structural integrity of the table construction when subjected to a racking load. Most racking failures occur upon dragging an unloaded table across a floor. The ability of a table to resist a racking load will indicate less damage to the structure. The following tests were based on and adapted from ANSI/BIFMA X5.5-1989 American National Standard for Office Furnishings “Desk Products-Tests.” Adjustments have been made to better accommodate the specific applications of tables used in laboratories.

10.3.2 Test Procedure

The table shall have a common two-by-four wood rail clamped on the centerline of the top parallel to the ends of the table. The table shall then be positioned at 45°, with one pair of legs on the floor and the other raised and supported (see Figure 15). To prevent the table from tipping over, attach a cable to the end rail of the table and to the wall. The attachment of the cable at the wall must be equal to or less than the height of the attachment at the table. The table shall then have 250 pounds (113.398 Kg) of weight (five 50-pound (22.679 Kg) bars) placed on its top and held in place by the two-by-four wood rail. The unit shall remain in this position for seventy-two hours. The unit shall be lowered without shock to the leveled surface and the general operation of the drawers shall be evaluated.

10.3.3 Acceptance Level

When returned to normal position, the operation of the table shall be normal, and there will be no permanent damage.

Endnotes:

1 Webster’s Ninth New Collegiate Dictionary, 1988, p 980.
3 ANSI/NEMA:  http://www.nema.org Standard LD-3 2005 (High-Pressure Decorative Laminate)
LABORATORY FURNITURE
CERTIFICATE OF PERFORMANCE

__________________________________ certifies that its laboratory furniture identified as the following:

(Company Name)
Combination Base Unit And Components for Tests 4.2; 4.3; 4.4; 4.5; 5.1; 5.2; 6.1; 6.2; 6.3; 6.4 and 7.1;
Laminates for Tests 8.1; 8.2; 8.3; 8.6 and 8.9: Edge Material for Tests 8.7 and 8.8: Wall Unit for Test 9.2; And
Tables for Tests 10.2 and 10.3 have been tested in conformance with the full requirements of the SEFA
8-PL-2016 Recommended Practices with results noted below.

Full documentation of the test results is available upon request in a bound report that includes a
detailed description of the test unit and procedures, witnesses results and appropriate drawings or
photographs of the test unit and procedures.

<table>
<thead>
<tr>
<th>TEST</th>
<th>TEST RESULTS PASS/FAIL</th>
<th>TEST</th>
<th>TEST RESULTS PASS / FAIL</th>
<th>TEST</th>
<th>TEST RESULTS PASS / FAIL</th>
</tr>
</thead>
<tbody>
<tr>
<td>4.2</td>
<td></td>
<td>6.3</td>
<td></td>
<td>8.7</td>
<td></td>
</tr>
<tr>
<td>4.3</td>
<td></td>
<td>6.4</td>
<td></td>
<td>8.8</td>
<td></td>
</tr>
<tr>
<td>4.4</td>
<td></td>
<td>6.5</td>
<td></td>
<td>8.9</td>
<td>ANSU/NEMA LD-3-2006 13.13</td>
</tr>
<tr>
<td>4.5</td>
<td></td>
<td>7.2</td>
<td></td>
<td>9.2</td>
<td></td>
</tr>
<tr>
<td>5.1</td>
<td></td>
<td>8.1</td>
<td>See Attached Form</td>
<td>10.2</td>
<td></td>
</tr>
<tr>
<td>5.1</td>
<td></td>
<td>8.2</td>
<td>ANSU/NEMA LD-3-2006 13.5</td>
<td>10.3</td>
<td></td>
</tr>
<tr>
<td>5.3</td>
<td></td>
<td>8.3</td>
<td>ANSU/NEMA LD-3-2006 13.8</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6.1</td>
<td></td>
<td>8.6</td>
<td>ANSU/NEMA LD-3-2006 13.5</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

COMPANY INFORMATION

Name:       
Address:   

TEST SUPERVISOR INFORMATION

Name:       
Title:     
Signature:  

COMPANY OFFICER INFORMATION

Name:       
Title:     

Date: 
Signature: 
CHEMICAL RESISTANCE TESTING – 8-PL-2016

Date of Test: ____________________________  Sample Description: _________________________

Type of Material Coated: ____________________  Coating Type: ______________________________

Rating Scale:    Level 0 – No Detectable Change
Level 1 – Slight Change in Color or Gloss
Level 2 – Slight Surface Etching or Severe Staining
Level 3 – Pitting, Cratering, Swelling, Erosion of Coating, Obvious and Significant Deterioration.

<table>
<thead>
<tr>
<th>#</th>
<th>CHEMICAL</th>
<th>RATING</th>
<th>COMMENTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Acetate, Amyl</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Acetate, Ethyl</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Acetic Acid 98%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Acetone</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Acid Dichromate 5%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Alcohol, Bury</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Alcohol, Ethyl</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Alcohol, Methyl</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>Ammonium Hydroxide 28%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>Benzene</td>
<td></td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>Carbon Tetrachloride</td>
<td></td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>Chloroform</td>
<td></td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>Chromic Acid 60%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>Cresol</td>
<td></td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>Dichloroacetic Acid</td>
<td></td>
<td></td>
</tr>
<tr>
<td>16</td>
<td>Dimethylformamide</td>
<td></td>
<td></td>
</tr>
<tr>
<td>17</td>
<td>Dioxane</td>
<td></td>
<td></td>
</tr>
<tr>
<td>18</td>
<td>Ethyl Ether</td>
<td></td>
<td></td>
</tr>
<tr>
<td>19</td>
<td>Formaldehyde 37%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>20</td>
<td>Formic Acid 90%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>21</td>
<td>Furfural</td>
<td></td>
<td></td>
</tr>
<tr>
<td>22</td>
<td>Gasoline</td>
<td></td>
<td></td>
</tr>
<tr>
<td>23</td>
<td>Hydrofluoric Acid 37%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>24</td>
<td>Hydrofluoric Acid 48%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>25</td>
<td>Hydrogen Peroxide 30%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>26</td>
<td>Iodine, Tincture of</td>
<td></td>
<td></td>
</tr>
<tr>
<td>27</td>
<td>Methyl Ethyl Ketone</td>
<td></td>
<td></td>
</tr>
<tr>
<td>28</td>
<td>Methylene Chloride</td>
<td></td>
<td></td>
</tr>
<tr>
<td>29</td>
<td>Monochlorobenzene</td>
<td></td>
<td></td>
</tr>
<tr>
<td>30</td>
<td>Naphthalene</td>
<td></td>
<td></td>
</tr>
<tr>
<td>31</td>
<td>Nitric Acid 20%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>32</td>
<td>Nitric Acid 30%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>33</td>
<td>Nitric Acid 70%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>34</td>
<td>Phenol 90%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>35</td>
<td>Phosphoric Acid 85%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>36</td>
<td>Silver Nitrate, Saturated</td>
<td></td>
<td></td>
</tr>
<tr>
<td>37</td>
<td>Sodium Hydroxide 10%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>38</td>
<td>Sodium Hydroxide 20%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>39</td>
<td>Sodium Hydroxide 40%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>40</td>
<td>Sodium Hydroxide, Flakes</td>
<td></td>
<td></td>
</tr>
<tr>
<td>41</td>
<td>Sodium Sulfide, Saturated</td>
<td></td>
<td></td>
</tr>
<tr>
<td>42</td>
<td>Sulfuric Acid 33%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>43</td>
<td>Sulfuric Acid 77%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>44</td>
<td>Sulfuric Acid 96%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>45</td>
<td>Sulfuric Acid 77%, and Nitric Acid 70%, equal parts</td>
<td></td>
<td></td>
</tr>
<tr>
<td>46</td>
<td>Toluene</td>
<td></td>
<td></td>
</tr>
<tr>
<td>47</td>
<td>Trichloroethylene</td>
<td></td>
<td></td>
</tr>
<tr>
<td>48</td>
<td>Xylene</td>
<td></td>
<td></td>
</tr>
<tr>
<td>49</td>
<td>Zinc Chloride, Saturated</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
# Table Of Contents (cont’d)

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>7.0 Shelving</strong></td>
<td>259</td>
</tr>
<tr>
<td>7.1 Description of Test Unit</td>
<td></td>
</tr>
<tr>
<td>7.2 Shelf Load Test</td>
<td></td>
</tr>
<tr>
<td>7.2.1 Purpose of Test</td>
<td></td>
</tr>
<tr>
<td>7.2.2 Test Procedure</td>
<td></td>
</tr>
<tr>
<td>7.2.3 Acceptance Level</td>
<td></td>
</tr>
<tr>
<td><strong>8.0 Cabinet Surface Finish Tests</strong></td>
<td>260</td>
</tr>
<tr>
<td>8.1 Chemical Spot Test</td>
<td></td>
</tr>
<tr>
<td>8.1.1 Purpose of Test</td>
<td></td>
</tr>
<tr>
<td>8.1.2 Test Procedure</td>
<td></td>
</tr>
<tr>
<td>8.1.3 Acceptance Level</td>
<td></td>
</tr>
<tr>
<td>8.2 Hot Water Test</td>
<td></td>
</tr>
<tr>
<td>8.2.1 Purpose of Test</td>
<td></td>
</tr>
<tr>
<td>8.2.2 Test Procedure</td>
<td></td>
</tr>
<tr>
<td>8.2.3 Acceptance Level</td>
<td></td>
</tr>
<tr>
<td>8.3 Impact Test</td>
<td></td>
</tr>
<tr>
<td>Not applicable to Polypropylene</td>
<td></td>
</tr>
<tr>
<td>8.4 Paint Adhesion Test</td>
<td></td>
</tr>
<tr>
<td>Not applicable to Polypropylene</td>
<td></td>
</tr>
<tr>
<td>8.5 Paint Hardness Test</td>
<td></td>
</tr>
<tr>
<td>Not applicable to Polypropylene</td>
<td></td>
</tr>
<tr>
<td>8.6 Dart Impact Test</td>
<td></td>
</tr>
<tr>
<td>Not applicable to Polypropylene</td>
<td></td>
</tr>
<tr>
<td>8.7 Edge Delaminating Test</td>
<td></td>
</tr>
<tr>
<td>Not applicable to Polypropylene</td>
<td></td>
</tr>
<tr>
<td>8.8 Edge Impact Test</td>
<td></td>
</tr>
<tr>
<td>Not applicable to Polypropylene</td>
<td></td>
</tr>
<tr>
<td>8.9 Wear Resistance (Abrasion) Test</td>
<td></td>
</tr>
<tr>
<td>Not applicable to Polypropylene</td>
<td></td>
</tr>
<tr>
<td><strong>9.0 Wall Cabinets, Counter Mounted and Tall Units</strong></td>
<td>265</td>
</tr>
<tr>
<td>9.1 Description of Test Unit</td>
<td></td>
</tr>
<tr>
<td>9.2 Load Test</td>
<td></td>
</tr>
<tr>
<td>9.2.1 Purpose of Test</td>
<td></td>
</tr>
<tr>
<td>9.2.2 Test Procedure</td>
<td></td>
</tr>
<tr>
<td>9.2.3 Acceptance Level</td>
<td></td>
</tr>
<tr>
<td><strong>10.0 Tables</strong></td>
<td>266</td>
</tr>
<tr>
<td>10.1 Description of Test Unit</td>
<td></td>
</tr>
<tr>
<td>10.2 Load Test</td>
<td></td>
</tr>
<tr>
<td>10.2.1 Purpose of Test</td>
<td></td>
</tr>
<tr>
<td>10.2.2 Test Procedure</td>
<td></td>
</tr>
<tr>
<td>10.2.3 Acceptance Level</td>
<td></td>
</tr>
<tr>
<td>10.3 Table Racking</td>
<td></td>
</tr>
<tr>
<td>Not applicable to Polypropylene</td>
<td></td>
</tr>
<tr>
<td><strong>Endnotes</strong></td>
<td>267</td>
</tr>
<tr>
<td><strong>Forms</strong></td>
<td>268</td>
</tr>
</tbody>
</table>
SEFA 8-P Committee Members

Committee Co-Chairs
Ken Dixon - Air Control, Inc.
Frank Conner - TFI Inline Design, Inc.

LM Air Technology, Inc.
Scientific Plastics
Foreword

SEFA Profile
The Scientific Equipment and Furniture Association (SEFA) is an international trade association comprised of manufacturers of laboratory furniture, casework, fume hoods and members of the design and installation professions. The Association was founded to promote this rapidly expanding industry and improve the quality, safety and timely completion of laboratory facilities in accordance with customer requirements.

SEFA Recommended Practices
SEFA and its committees are active in the development and promotion of Recommended Practices having domestic and international applications. Recommended Practices are developed by the association taking into account the work of other standard writing organizations. Liaison is also maintained with government agencies in the development of their specifications.

SEFA’s Recommended Practices are developed in and for the public interest. These practices are designed to promote a better understanding between designers, architects, manufacturers, purchasers, and end-users and to assist the purchaser in selecting and specifying the proper product to meet the user’s particular needs. SEFA’s Recommended Practices are periodically updated. The Recommended Practices are numbered to include an annual suffix which reflects the year that they were updated. SEFA encourages architects to specify these Recommended Practices as follows: “SEFA 8P-2014”.

SEFA Glossary of Terms
SEFA has developed a Glossary of Terms (SEFA 4-2010) for the purpose of promoting a greater understanding between designers, architects, manufacturers, purchasers and end users. The terms defined by SEFA are frequently used in contracts and other documents, which attempt to define the products to be furnished or the work involved. The Association has approved this Glossary in an effort to provide uniformity among those who use these terms. Where a specific Recommended Practice contains definitions which differ from those in the Glossary of Terms, then the definitions in the specific Recommended Practice should be used.

SEFA encourages all interested parties to submit additional terms or to suggest any changes to those terms already defined by the Association. The definitions should be used to help resolve any disputes that may arise or to incorporate the applicable terms in any contract or related documents.

SEFA Disclaimer
SEFA uses its best effort to promulgate Recommended Practices for the benefit of the public in light of available information and accepted industry practices. SEFA does not guarantee, certify or assure the safety or performance of any products, components, or systems tested, installed, or operated in accordance with SEFA Recommended Practices or that any tests conducted under its Recommended Practices will be non-hazardous or free from risk. SEFA encourages the use of third party independent testing where appropriate.

Note: Testing as described in this document must be performed and documented by a SEFA-approved third party testing facility. See Page 34 of the SEFA Desk Reference 5th Edition Version 2.0, or visit us at SEFALABS.COM for the most current list of SEFA-approved test labs.
1.0 Scope

The scope of this document is intended to provide manufacturers, specifiers, and users tools for evaluating the safety, durability, and structural integrity of polypropylene laboratory grade furniture and complimentary items. This document is inclusive of casework (base units, wall mounted units, counter mounted units, tall units, tables and, shelving systems). Casework, tables, and shelving manufactured for laboratory use should be subjected to the tests and procedures outlined below.

Polypropylene laboratory grade casework shall consist of base cabinets, wall cabinets, counter mounted cabinets, tall cabinets, tables, and shelving.

Aggregate test results may vary by manufacturer. Procedures for testing performance criteria shall be as outlined in this document and results made available upon request. It is assumed that the test model reflects the performance criteria for all products. However, there may be certain door/drawer configurations and/or sizes outside the test unit configuration identified that may not meet certain parts of this test. A test unit has been identified in this document with the sole purpose of obtaining continuity of procedures and results in a scientific format.

Great care should be exercised when heavy loads are applied to the cabinet and appropriate safety precautions taken to insure safety of testing personnel. Properly trained personnel should perform all tests. SEFA assumes no liability for damage or injury as a result of conducting these tests.

The acceptance levels are based on the cumulative field experience and laboratory testing of SEFA members based on actual needs of laboratories. This is a performance-based document. Specifications proscribing specific materials, hardware, finishes, workmanship or construction may or may not meet acceptance levels of this document. If proscriptive components of the specifications conflict with compliance of this document then the Architectural proscribed elements take precedence.

Testing as outlined in this document must be performed and documented by a SEFA-approved independent third party testing facility.

2.0 Purpose

The purpose of this document is to describe the distinguishing performance characteristics of laboratory grade polypropylene furniture and complimentary items. Furniture shall be of a type specifically designed and manufactured for installation and use in a laboratory.

Although aggregate test results may vary from manufacturer to manufacturer, procedures for testing performance criteria shall be as outlined in this document and results made available upon request. It is assumed that the test model reflects the performance criteria for all products regardless of construction, size, or style used. A test unit has been identified in this document with the sole purpose of obtaining continuity for procedures and results in a scientific format.

3.0 Definitions

Acceptance Levels - The acceptance level for each performance criteria is based on the cumulative experience of actual field testing and laboratory results of SEFA members. Acceptance levels describe the expected outcome of each test procedure.

ANSI/BIFMA - ANSI is the American National Standards Institute. Approval of an American National Standard requires verification by ANSI that the requirements for due process, consensus, and other criteria for approval have been met by the standards developer. BIFMA is the Business and Institutional Furniture Manufacturer’s Association, an association of manufacturers of desk products and the like.

Apparatus - A machine or group of machines and accessories.

Arithmetic Mean - A number obtained by dividing the sum of a set of quantities by the number of quantities in a set; average.

**Base Cabinets** - A base cabinet is a storage device consisting of two ends, a back, a face and may or may not include a top or top frame. The face may be open, to access the storage area, or may be outfitted with one or more drawers and/or doors. A base cabinet is always placed on the floor and normally supports a surface. The top surface is normally no more than 42” (1,067mm) off the floor surface.

**Best Practices** - When given a choice of grade, the “best practice” is to select one that offers a well defined degree of control over the quality of workmanship, materials, and installation of a project. SEFA-8 Recommended Practices are written from a view of high quality laboratory furniture.

**Cabinet Depth (Deep)** - Given a front, bottom, two sides, and a top, the cabinet depth is a measure of the side of the cabinet, in its normal upright position, from the outside back to the outside front excluding doors and door fronts.

**Cabinet Height (High)** - Given a front, bottom, two sides, and a top, the cabinet height is a measure of the side of the cabinet, in its normal upright position, from the bottom edge of the side to the top, excluding any surface.

**Cabinet Width (Wide)** - Given a front, bottom, two sides, and a top, the cabinet width is a measure of the front of the cabinet in its normal upright position from one side to the other.

**Casework** - Base and wall cabinets, display fixtures, and storage shelves. The generic term for both “boxes” and special desks, reception counters, nurses stations and the like. Generally includes the tops and work surfaces.

**Chase (Plumbing Area)** - Space located behind the back of the base cabinet used to house plumbing or electric lines.

**Combination Unit** - A base unit of the type that has both door(s) and drawer(s).

**Counter Mounted Cabinet** - A counter mounted cabinet is a wall cabinet (usually with a height of approximately 48” [1,219mm] and is typically mounted on the work surface or shelf, as in a reagent shelf).

**Cupboard (Door Unit)** - That portion of the cabinet with no drawer(s) that may be enclosed by doors.

**Drawer** - A sliding storage box or receptacle opened by pulling out and closed by pushing in.

**Free Standing** - Requiring no support or fastening to other structures.

**Hardware** - Items such as screws, pulls, hinges, latches, locks, and drawer slides used in the construction of casework.

**Joinery** – The junction of two pieces intended to be permanently connected.

**Laboratory Furniture** - Furniture designed and manufactured for installation and use in a laboratory.

**Latch** - A piece of hardware designed to hold a door closed.

**Leveling Screws (Levelers)** - Threaded components designed to allow adjustment of the cabinet vertically as needed for leveling.

**Nominal Dimensions** - Not all cabinet manufacturers produce product to the identical dimensions. All dimensions given in this document are accurate to within five percent, which is considered nominal.

**Permanent Damage** - Destruction to material or joinery that would require repair in order to return to its original state.

**Permanent Deformation** - Deflection that has exceeded the limits of the product, thus changing the original shape of the product.

**Permanent Deterioration** - Erosion or corrosion of material such that the component will never return to its original shape.
**Permanent Failure** - See “permanent damage.”

**Pulls** - Articles of hardware used to grasp and open/close the door or drawer (see also hardware).

**Rack Resistance** - The ability of a product to resist stresses that tend to make the product distort and the drawers to become misaligned.

**Rail** - A horizontal member extending from one side of the cabinet to the other.

**Reagent** - A substance used because of its chemical or biological activity.

**Removable Back** - A panel located on the inside back of the base cabinet, which is removable in order to gain access to utilities.

**Submersion** - Covered with water.

**Tables** - An article of furniture having a flat, horizontal surface supported by one or more support members (legs), and a frame (apron).

**Tall Cabinet (Full Height Unit)** - A tall cabinet is a storage device that consists of two ends, a top and bottom panel, a back and a face. The face may be open to access the storage area or may be outfitted with one or more drawers and/or door(s). A tall cabinet is always placed on the floor and is nominally 84” (2,134mm) high.

**Torsion** – A force acting at a distance which tends to twist or rotate an object or cabinet.

**Uniformly Distributed** – A force applied evenly over the area of a surface.

**Unobstructed Entry** - A cabinet is deemed to be unobstructed if access to the entire storage area is completely without obstacle.

**Upright Position** - A cabinet oriented in its intended position.

**Wall Cabinet** - A wall cabinet is a storage device consisting of two ends, a back, a top, bottom, and a face. The face may be open to access the storage area or may be outfitted with one or more door(s). The wall cabinet usually does not include a drawer. A wall cabinet is always mounted on a vertical surface such as a wall, a divider, panel or some other vertical structure. A wall cabinet is usually less than 48” (1,219mm) high.

**Work Surface** - A normally horizontal surface used to support apparatus at a convenient height above the floor. Work surfaces are normally positioned atop a base cabinet or table structure.

### 3.1 Description of Testing Apparatus

**Solid Steel Bar** - A square solid steel bar 2 1/2” (63mm) square, 28 1/4” (717mm) long, weighing 50 pounds (22.679 Kg).

**Sand or Shot Bag (10 pounds [4.545 Kg])** - A bag of plastic or cloth with the approximate dimensions 10 9/16” (268mm) x 11” (279mm) as in typical “gallon size re-closable stor-age bags.” Filled with enough sand or shot so that contents weigh 10 pounds (4.545 Kg).

**Sand Bag (20 pounds [9.071 Kg])** - Two 10 pound (4.545 Kg) sand bags bound together.

**Shot Bag (100 lbs. [45.359 Kg])** - A plastic or cloth bag of sufficient size to contain 100 pounds (45.359 Kg) of shot.

**Cycling Mechanism** - Per ANSI BHMA 156.9.-2003

**Steel Rod** - A 2” (51mm) diameter by 12” (305mm) long rod, approximately 10 pounds (4.535 Kg) in weight.

**Hot Water** - To be considered “hot water,” the temperature of the water must be between 190º F to 205º F (88º C to 96º C).

**One Pound Ball** - Solid steel sphere approximately 2” (51mm) in diameter.

**Hardwood Corner Block** - A block of hardwood 2” (51mm) square by 1” (25.4mm) high.
4.0  Base Cabinets

4.1  Description of Test Cabinet

The base cabinet shall be a combination of doors and drawers per Figure 1. The base cabinet shall have nominal dimensions of 48” (1,219.2mm) wide, 36” (914.4mm) high, and 22” (558.8mm) deep. The drawers shall be above the doors, half width and approximately one-fourth the height of the cabinet’s face opening. The cabinet back shall be the removable type (per manufactures’ standard design as used for access to the plumbing or chase area) with the removable panel removed.

The cabinet shall be free standing, squared and leveled. For purposes of testing, the cabinet shall be squared and leveled and sitting 1” (25.4mm) off the floor atop four hardwood corner blocks 2” (50.8mm) square and 1” (25.4mm) high. A top of 1” (25.4mm) thick 37-50 pcf medium density fiberboard shall be positioned on the cabinet without glue or fasteners of any kind. The top dimensions will be such that it will overhang the cabinet perimeter by 1” (25.4mm). Its weight shall be included in the test as live load.

Before conducting the test, a visual examination shall be conducted to verify that the unit configuration and setup conditions are appropriate. Operate doors and drawer. Doors should be free moving and latch properly. Inspect the unit for dimensions and note the fit of doors and drawers to the cabinet body. Open and close the drawer. The drawer should be free moving and function as specified by the manufacturer. Discontinue evaluation if unit is not in compliance or if malfunction is noted.

4.2  Cabinet Load Test

4.2.1  Purpose of Test

The cabinet load test will challenge the structural integrity and load bearing capability of the cabinet construction. This test will demonstrate the ability of the cabinet to support heavy applied loads. This is not intended to test the functional characteristics of the cabinet under heavy loads.

4.2.2  Test Procedure

Verify that the cabinet is level. Remove drawer and open doors for testing purpose. Load the cabinet top by using 1600 pounds (725.755 Kg) of solid steel bars (per Section 3.1) stacked in an evenly distributed manner across the entire top surface, per Figure 2. After ten minutes unload the cabinet.

4.2.3  Acceptance Level

The cabinet will have no permanent failure.

4.3  Cabinet Concentrated Load Test

4.3.1  Purpose of Test

The purpose of this test is to challenge the functional characteristics of the cabinet when subjected to a concentrated load on the center of the cabinet top.
4.3.2 **Test Procedure**

Using solid weights or 10 pound (4.535 Kg) sand bags (per Section 3.1), apply a total of 160 pounds (72.576 Kg) to the top of the cabinet along the cabinet centerline (see Figure 3). Operate doors and drawers.

4.3.3 **Acceptance Level**

Under condition of test load, doors and drawers shall operate normally. There shall be no permanent distortion to front rail, cabinet joinery, doors or drawers.

4.4 **Cabinet Torsion**

4.4.1 **Purpose of Test**

This test will evaluate the structural integrity of the cabinet construction when subjected to a torsional load.

4.4.2 **Test Procedure**

The cabinet shall be tested in its normal upright position, raised not less than four-inches off the floor and supported on rear and one front corner. The area of support under the cabinet shall be located not more than 6" (152.4 mm) in from each supported corner. Secure the cabinet diagonally from the unsupported corner with solid steel bars or sand bags per Section 3.1, 280 pounds (127.27 Kg) of weight on the top of the cabinet to prevent overturning. Apply solid weights or sand bags to achieve 160 pounds of weight [72.73 Kg] to the unsupported corner for a period of fifteen minutes (see: Figure 4). Remove weight and place cabinet on the floor in its normal upright position. Observe cabinet joinery. Level the cabinet and measure the face and back of the cabinet across the diagonal corners.

4.4.3 **Acceptance Level**

When returned to normal position, the operation of the cabinet shall be normal, and there will be no permanent damage. The difference between the two measurements taken from measuring the diagonal corners shall be no more than 1/8" (3.175mm).

4.5 **Cabinet Submersion Test**

4.5.1 **Purpose of Test**

This test will demonstrate the ability of a cabinet to resist wicking of moisture from the floor. Only units that rest on the floor or a unit where the base is within 2" (50.8mm) of the floor should be subjected to this test.

4.5.2 **Test Procedure**

The material thickness along the perimeter of the cabinet shall be measured on 6" (152.4mm) increments. Record the thickness of the material to be submerged in water. Calculate the arithmetic mean of the data taken. Place the entire test cabinet in its upright position such that the cabinet is submerged in a deep pan so that the cabinet is in 24" (609.6mm) of water. After four hours, remove the unit from the water and immediately measure the thickness of the material at the same points measured initially. Calculate
the new arithmetic mean. After the unit has been allowed to dry, inspect for other damage.

4.5.3 Acceptance Level

The cabinet will show no permanent deformation or deterioration. Increase in thickness shall not exceed four percent of the initial mean measurements.

4.6 Spill Containment Test

4.6.1 Purpose of Test

This test will demonstrate the ability of a cabinet to hold standing water. Any polypropylene cabinet, be it floor mounted, wall case, or under counter mount, should have the ability to hold said water, for an infinite amount of time.

4.6.2 Test Procedure

The cabinet shall be tested in its normal upright position, raised not less than four-inches off the floor, and supported level. The supports should be stationed away from all weld seam areas, on the underside. Fill cabinet with water, engulfing whole bottom, to within 1/8" of top, of bottom rail. Let stand for one hour. Inspect for water droplets, if droplets found, mark area on cabinet, with colored tape, grind out weld, re-weld, and repeat procedure.

4.6.3 Acceptance Level

The cabinet will show no signs of leakage, and have no gaps, or voids in weld seams. The cabinet will show no signs of permanent deformation or deterioration.

5.0 Doors

5.1 Door Hinge Test

5.1.1 Purpose of Test

This test will demonstrate the durability of the door and its hardware (hinge leaf, screws, etc.) to an applied load of 120 pounds (54.43 Kg).

5.1.2 Test Procedure

With unit and top set as described in Section 4.1, add sufficient weight to the top in order to prevent overturning. With cabinet door opened 90-degrees, hang a sling made up of sand bags of 120 pounds (54.43 Kg) weight over top of the door at a point 12" (304.8mm) out from the hinge centerline (see Figure 5). Slowly move door through the full cycle of the hinge, up to a 160-degree arc. Remove weight and swing door through its full intended range of motion and close door.

5.1.3 Acceptance Level

The open door shall withstand a load of 120 pounds (54.43 Kg) when applied at a point 12" (304.8mm) from the hinge centerline without significant permanent distortion. Operation of the door, after test, shall show no significant permanent distortion that will cause binding of the door or hinges or that will adversely affect operation of the catch.

5.2 Door Impact Test

5.2.1 Purpose of Test

This test will demonstrate the resistance of a 190 inch-pound impact to the door face. Only units that extend below the work surface should be
subjected to this test. This test should not be inclusive of glass doors.

5.2.2 Test Procedure

With unit and top set as described in Section 4.1, add sufficient weight to the top in order to prevent overturning. A 10 pound (4.534 Kg) sand bag (per Section 3.1) shall be suspended and dropped to provide an impact of 190 inch-pounds at the center of the closed door (see Figure 6).

5.2.3 Acceptance Level

After the test, the door and catch shall operate normally and show no permanent damage.

5.3 Door Cycle Test

5.3.1 Purpose of Test

This test will demonstrate the durability of the door hinge hardware to withstand 50,000 cycles as a reliable measure for longevity.

5.3.2 Test Procedure

This test shall be in conformance to the ANSI test procedure A156.9, Grade 1, requirements for cycle testing of doors. A cycling mechanism shall swing door 90-degrees. Door shall operate for 50,000 cycles with a speed not greater than 8 cycles per minute.

5.3.3 Acceptance Level

Door shall operate for the full cycle period without deterioration that will significantly affect the function of the door. The door shall operate freely without binding.

6.0 Drawers

6.1 Drawer Static Test

6.1.1 Purpose of Test

This test will demonstrate the ability to support a point load given to the front of the drawer and will challenge the attachment of the drawer head to the drawer.

6.1.2 Test Procedure

With unit and top set as described in Section 4.1, add sufficient weight to the top in order to prevent overturning. Open the drawer to 13” (330.2mm) of travel and hang 120 pounds (54.43 Kg) from the drawer head at the centerline of the drawer for five minutes (see Figure 7). Remove the weight and operate the drawer through the full cycle.

6.1.3 Acceptance Level

There shall be no interference with the normal operation of the drawer.
6.2 **Drawer and Door Pull Test**

6.2.1 **Purpose of Test**

This test will evaluate the strength of the pull and pull hardware.

6.2.2 **Test Procedure**

Pulls are to be installed in accordance with manufacturer’s practice using specified attaching hardware and method. Block door and drawer closed. Using a cable, pulley and weight assembly (see Figure 8), apply a force of 40 pounds (18.144 Kg) perpendicular to each pull. Revise setup to hang weight from each pull (see Figure 9). Remove weight.

6.2.3 **Acceptance Level**

Pulls shall resist force and support weight without breakage. After completion of test and removal of weight, there shall be no significant permanent distortion. Some pull designs will require variations to set up apparatus. These pulls shall be tested in conformance to the applied pull forces.

6.3 **Drawer Impact Test**

6.3.1 **Purpose of Test**

This test will demonstrate the resistance to impact of the drawer bottom and slide mechanism.

6.3.2 **Test Procedure**

Open drawer to 13” (330.2mm) of travel. Drop an 8 pound (3.629 Kg) sand or shot bag from a height of 24” (609.6mm) into the bottom of a drawer at the center of the width of the drawer and 6” (152.4mm) back from the inside face of the drawer. Remove the sand or shot bag.

6.3.3 **Acceptance Level**

Operate drawer through full cycle. Drawer shall operate normally. Any deformation will not cause binding or interfere with the operation of the drawer.

6.4 **Drawer Internal Rolling Impact Test**

6.4.1 **Purpose of Test**

This test will evaluate the strength of the drawer head, bottom, and back as a result of opening and closing the drawer with a rolling load.

6.4.2 **Test Procedure**

Position the drawer on a table at a 45-degree angle per Figure 10. Place a 2” (50.8mm) diameter by 12” (304.8mm) long steel rod (approximately 10 pounds [4.536Kg]) 13” (330.2mm) from the target impact area such that the rod will roll freely to impact the back of the drawer. Subject the back to three impacts and reverse the drawer to subject the front to three additional impacts.
6.4.3 Acceptance Level

The drawer shall show no permanent damage. All joinery shall be intact and the drawer, when replaced in the unit, shall operate normally. Minor scratches and dents are acceptable.

6.5 Drawer Cycle Test

6.5.1 Purpose of Test

This test is intended to replicate years of operation of a drawer under a load.

6.5.2 Test Procedure

Laboratory Load (10 pounds [4.535 Kg]) - A static load of 10 pounds (4.535 Kg) (using a ten 10 pound [4.359 Kg] sand bag per Section 3.1) shall be uniformly distributed in the drawer. Measure force required to activate the drawer. Operate from a closed position to within 1/4” (6.35mm) of full extension for 25,000 cycles at a rate not to exceed 4 cycles per minute.

6.5.3 Acceptance Level

The drawer shall operate freely without evidence of dragging rubbing or binding. The force required to open and close loaded drawer shall not be more than a 20% increase of that required prior to test and shall not be greater than 8 pounds (3.487 Kg) to activate hardware.*

* The American’s with Disabilities Act (ADA) requires a force no greater than five pounds to activate hardware. The load rating in this document is intended only for testing conditions where loads challenge the durability of the hardware. Under actual conditions, drawer loading should be reduced to levels that result in compliance with ADA as applicable.

7.0 Shelving

7.1 Description of Test Unit

Shelves shall be tested using the following procedure. This is inclusive of shelves in wall cabinets, counter mounted cabinets, full height cabinets, wall mounted shelves and free standing shelves. Typical thicknesses are 1/2” for most applications. Shelves to have lips on at least two sides. Other factors that should be evaluated when selecting shelving include chemical resistance, impact resistance, color and appearance, abrasion resistance, cost, and support requirements. Consult with the manufacturer for assistance with these other criteria.

7.2 Shelf Load Test

7.2.1 Purpose of Test

This test will demonstrate the ability of a shelf and its mounting hardware to support normal laboratory loads.

7.2.2 Test Procedure

A shelf shall be mounted in the manner in which it is designed. Measure the distance from the underside of the shelf to a reference point perpendicular to the center of the shelf. Use sand bags weighing 10 pounds (4.545 Kg) each. Unless otherwise specified, load the shelf uniformly to 10 pounds (4.545 Kg) per square foot shelf area to a maximum of 75 pounds (30.01 Kg). Measure the deflection on the shelf by measuring the distance to the reference point and calculating the difference between the two measurements. Record data and remove load from the shelf.
7.2.3 Acceptance Level

Longer shelves will support less loads than shorter shelves. The allowable maximum deflection of a shelf is 1/180 of the span and not in excess of .25” (6.35mm). The following formula may be used to calculate the approximate deflection expected from a uniformly distributed load:

\[ D \ (\text{max.}) = \frac{5W L^3}{384E I} \]

Where:

- **D** = Deflection in inches (Maximum 1/180 span, not to exceed .25” (6.35mm)).
- **W** = (Design Load) x (Shelf Depth in Inches) x (Shelf Span in Inches)
- **L** = Span between supports in inches
- **E** = Modulus of Elasticity per ASTM D790 (Polypropylene = 185,000)
- **I** = Cross section moment of inertia
  \[ I = \frac{bh^3}{12} \] (Shelf Depth in Inches x Shelf Thickness in Inches cubed)/12.

**POLYPROPYLENE EXAMPLE:**

Assuming Shelf is ½” thick x .20” deep x 48” wide but with support in middle of shelf (L =24”)

**Design Load = 10 pounds/144 = .07**

\[ L = 24” \]

\[ I = \frac{(20”)(.5”)}{3}/12 = .21 \]

**Solve for W = (.07) x (20”) x (24”) = 33.6**

\[ D \ (\text{max.}) = \frac{5 (33.6) (24^3)}{384 (185,000) (.21)} = 2,322,432/14,918,400 = .15” \text{ Deflection} \]

**NOTE:** Polypropylene shelves typically have welded lips, stiffeners, and/or cross members, depending on manufacturer. Any such thickness enhancers act to increase Moment of Inertia (I) and thereby decrease **D (max.)** deflection or allow for higher shelf loads. Above calculations are without any added stiffeners.

8.0 Cabinet Surface Finish Tests

8.1 Chemical Spot Test

Users should consider the chemical and staining agents that might be used near the laboratory casework. Common guidelines can be found by referring to: The casework manufacturer printed data for chemical and stain resistance. Because chemical and stain resistance is affected by concentration, time, temperature, humidity, housekeeping and other factors, it is recommended that users test samples in their actual environment with the substances they use.

8.1.1 Purpose of Test

The purpose of the chemical spot test is to evaluate the resistance a finish has to chemical spills.

**Note:** Many organic solvents are suspected carcinogens, toxic and/or flammable. Great care should be exercised to protect personnel and the environment from exposure to harmful levels of these materials.

8.1.2 Test Procedure

Sample substrate will be red oak, rift-cut veneer without stain underneath the coating. Panels to be finished according to finishing supplier’s guidelines and in accordance to casework manufacturer’s standard procedures.

Obtain one sample panel measuring 14” x 24” (355.6mm x 609.6mm). The received sample to be tested for chemical resistance as described herein. Place panel on a flat surface, clean with soap and water and blot dry. Condition the panel for 48-hours at 73º +/- 3ºF (23º +/- 2ºC) and 50 +/- 5% relative humidity or the currently accepted guideline set by ASTM. Test the panel for chemical resistance using forty-nine different chemical reagents by one of the following methods.
Method A - Test volatile chemicals by placing a cotton ball saturated with reagent in the mouth of a 1-oz. (29.574cc) bottle and inverting the bottle on the surface of the panel.

Method B - Test non-volatile chemicals by placing five drops of the reagent on the surface of the panel and covering with a 24mm watch glass, convex side down.

For both of the above methods, leave the reagents on the panel for a period of one hour. Wash off the panel with water, clean with detergent and naptha, and rinse with deionized water. Dry with a towel and evaluate after 24-hours at 73º +/- 3ºF (23º +/- 2ºC) and 50 +/- 5% relative humidity, or the currently accepted guideline set by ASTM using the following rating system.

Level 0 - No detectable change.
Level 1 - Slight change in color or gloss.
Level 2 - Slight surface etching or severe staining.
Level 3 - Pitting, cratering, swelling, or erosion of coating. Obvious and significant deterioration.

Note: Percentages are by volume.

8.1.3 Acceptance Level

Range of results is provided to establish the acceptable range for a Laboratory Grade Finish. Results will vary from manufacturer to manufacturer due to differences in finish formulations. Laboratory grade finishes shall result in no Level 3 conditions. Individual test results, for the specified 49 reagents, will be verified with the established third party, independent SEFA 8 test submittal form. Suitability for a given application is dependent upon the chemicals used in a given laboratory.

<table>
<thead>
<tr>
<th>Test No.</th>
<th>Chemical Reagent</th>
<th>Test Method</th>
<th>Rating</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Acetate, Amyl</td>
<td>A</td>
<td>0</td>
</tr>
<tr>
<td>2.</td>
<td>Acetate, Ethyl</td>
<td>A</td>
<td>0</td>
</tr>
<tr>
<td>3.</td>
<td>Acetic Acid, 98%</td>
<td>B</td>
<td>0</td>
</tr>
<tr>
<td>4.</td>
<td>Acetone</td>
<td>A</td>
<td>0</td>
</tr>
<tr>
<td>5.</td>
<td>Acid Dichromate, 5%</td>
<td>B</td>
<td>0</td>
</tr>
<tr>
<td>6.</td>
<td>Alcohol, Butyl</td>
<td>A</td>
<td>0</td>
</tr>
<tr>
<td>7.</td>
<td>Alcohol, Ethyl</td>
<td>A</td>
<td>0</td>
</tr>
<tr>
<td>8.</td>
<td>Alcohol, Methyl</td>
<td>A</td>
<td>0</td>
</tr>
<tr>
<td>9.</td>
<td>Ammonium Hydroxide, 28%</td>
<td>B</td>
<td>0</td>
</tr>
<tr>
<td>10.</td>
<td>Benzene</td>
<td>A</td>
<td>0</td>
</tr>
<tr>
<td>11.</td>
<td>Carbon Tetrachloride</td>
<td>A</td>
<td>0</td>
</tr>
<tr>
<td>12.</td>
<td>Chloroform</td>
<td>A</td>
<td>0</td>
</tr>
<tr>
<td>13.</td>
<td>Chromic Acid, 60%</td>
<td>B</td>
<td>0</td>
</tr>
<tr>
<td>14.</td>
<td>Cresol</td>
<td>A</td>
<td>0</td>
</tr>
<tr>
<td>15.</td>
<td>Dichloroacetic Acid</td>
<td>A</td>
<td>0</td>
</tr>
<tr>
<td>16.</td>
<td>Dimethylformamide</td>
<td>A</td>
<td>0</td>
</tr>
<tr>
<td>17.</td>
<td>Dioxane</td>
<td>A</td>
<td>0</td>
</tr>
<tr>
<td>18.</td>
<td>Ethyl Ether</td>
<td>A</td>
<td>0</td>
</tr>
<tr>
<td>19.</td>
<td>Formaldehyde, 37%</td>
<td>A</td>
<td>0</td>
</tr>
<tr>
<td>20.</td>
<td>Formic Acid, 90%</td>
<td>B</td>
<td>0</td>
</tr>
<tr>
<td>21.</td>
<td>Furfural</td>
<td>A</td>
<td>0</td>
</tr>
<tr>
<td>22.</td>
<td>Gasoline</td>
<td>A</td>
<td>0</td>
</tr>
<tr>
<td>23.</td>
<td>Hydrofluoric Acid, 37%</td>
<td>B</td>
<td>0</td>
</tr>
<tr>
<td>24.</td>
<td>Hydrofluoric Acid, 48%</td>
<td>B</td>
<td>0</td>
</tr>
<tr>
<td>25.</td>
<td>Hydrogen Peroxide, 30%</td>
<td>B</td>
<td>0</td>
</tr>
<tr>
<td>26.</td>
<td>Iodine, Tincture of Iodine</td>
<td>B</td>
<td>0</td>
</tr>
<tr>
<td>27.</td>
<td>Methyl Ethyl Ketone</td>
<td>A</td>
<td>0</td>
</tr>
<tr>
<td>28.</td>
<td>Methylen Chloride</td>
<td>A</td>
<td>0</td>
</tr>
<tr>
<td>29.</td>
<td>Mono Chlorobenzene</td>
<td>A</td>
<td>0</td>
</tr>
<tr>
<td>30.</td>
<td>Naphthalene</td>
<td>A</td>
<td>0</td>
</tr>
<tr>
<td>31.</td>
<td>Nitric Acid, 20%</td>
<td>B</td>
<td>0</td>
</tr>
<tr>
<td>32.</td>
<td>Nitric Acid, 30%</td>
<td>B</td>
<td>0</td>
</tr>
<tr>
<td>33.</td>
<td>Nitric Acid, 70%</td>
<td>B</td>
<td>2</td>
</tr>
<tr>
<td>34.</td>
<td>Phenol, 90%</td>
<td>A</td>
<td>0</td>
</tr>
<tr>
<td>35.</td>
<td>Phosphoric Acid, 85%</td>
<td>B</td>
<td>0</td>
</tr>
<tr>
<td>36.</td>
<td>Silver Nitrate Saturated</td>
<td>B</td>
<td>0</td>
</tr>
<tr>
<td>37.</td>
<td>Sodium Hydroxide 10%</td>
<td>B</td>
<td>0</td>
</tr>
<tr>
<td>38.</td>
<td>Sodium Hydroxide 20%</td>
<td>B</td>
<td>0</td>
</tr>
<tr>
<td>39.</td>
<td>Sodium Hydroxide 40%</td>
<td>B</td>
<td>0</td>
</tr>
<tr>
<td>40.</td>
<td>Sodium Hydroxide Flake</td>
<td>B</td>
<td>0</td>
</tr>
<tr>
<td>41.</td>
<td>Sodium Sulfide Saturated</td>
<td>B</td>
<td>0</td>
</tr>
<tr>
<td>42.</td>
<td>Sulfuric Acid, 33%</td>
<td>B</td>
<td>0</td>
</tr>
<tr>
<td>43.</td>
<td>Sulfuric Acid, 77%</td>
<td>B</td>
<td>0</td>
</tr>
<tr>
<td>44.</td>
<td>Sulfuric Acid, 96%</td>
<td>B</td>
<td>0</td>
</tr>
<tr>
<td>45.</td>
<td>Sulfuric Acid 77% &amp; Nitric Acid 70% equal parts</td>
<td>B</td>
<td>2</td>
</tr>
<tr>
<td>46.</td>
<td>Toluene</td>
<td>A</td>
<td>1</td>
</tr>
<tr>
<td>47.</td>
<td>Trichloroethylene</td>
<td>A</td>
<td>1</td>
</tr>
<tr>
<td>48.</td>
<td>Xylene</td>
<td>A</td>
<td>0</td>
</tr>
<tr>
<td>49.</td>
<td>Zinc Chloride, Saturated</td>
<td>B</td>
<td>0</td>
</tr>
</tbody>
</table>
8.1.4 Additional Chemical Resistance Data for Polypropylene (PP) and Fire-Retardant Polypropylene (FRPP - UL 94 V/O Grade)

The following data is made available from several manufacturers of polypropylene extruded sheet, which is used in the manufacture of polypropylene casework and fume hoods. Polypropylene casework and hood manufacturers do not alter the chemical resistance of original raw extruded sheet when manufacturing their casework and hoods, and other polypropylene furniture. No coatings, laminates, or any other changes to raw stock are made before and during the manufacturing of polypropylene furniture. Therefore chemical resistance data as provided by the raw sheet manufacturers should be no different than resistance data of finished furniture.

The test protocols range in detail between raw sheet manufacturers but none are less stringent than above chemical contact test described in Section 8.1.2. Many immerse polypropylene samples in chemicals for several hours and even days.

The following is a more extensive list of chemicals which are compatible with polypropylene. These are provided to offer specifiers greater chemical compatibility information for most commonly used chemicals.

The following data describes the highest temperature (F) of the particular chemical for which polypropylene is recommended (R), without significant adverse effect (No Level “3”s). Because elevated temperatures of many chemicals increase their corrosive effect on materials (some dramatically), it is important to include this temperature data for more meaningful information purposes.

Chemical Resistance Chart Disclaimer

The data in the following tables were obtained from numerous polypropylene resin manufacturers in the industry. The information is based primarily on the immersion or spot testing of unstressed sample strips or wafers in the chemicals listed at ambient and elevated temperatures and, to a lesser degree, on filed experience with various products. The end user should be aware of the fact that the actual service conditions will affect the chemical resistance. The chemical resistance table should be used for a reference guide. It is the ultimate responsibility of the end user to determine the compatibility or suitability of the chemicals and materials being used in their particular application.

\[
\begin{align*}
R &= \text{Recommended up to temperature indicated} \\
NR &= \text{Not Recommended}
\end{align*}
\]
<table>
<thead>
<tr>
<th>Chemical Concentrations</th>
<th>PP</th>
<th>FRPP</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acetic Acid 3%</td>
<td>R-200F</td>
<td>R-200F</td>
</tr>
<tr>
<td>Acetic Acid 10%</td>
<td>R-200F</td>
<td>R-200F</td>
</tr>
<tr>
<td>Acetic Acid 50%</td>
<td>R-185F</td>
<td>R-185F</td>
</tr>
<tr>
<td>Acetic Acid 60%</td>
<td>R-180F</td>
<td>R-180F</td>
</tr>
<tr>
<td>Alcohol</td>
<td>R-120F</td>
<td></td>
</tr>
<tr>
<td>Alcohol</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Amyl</td>
<td>R-170F</td>
<td></td>
</tr>
<tr>
<td>Butyl</td>
<td>R-180F</td>
<td></td>
</tr>
<tr>
<td>Ethyl</td>
<td>R-100F</td>
<td>R-100F</td>
</tr>
<tr>
<td>Isobutyl</td>
<td>R-140F</td>
<td></td>
</tr>
<tr>
<td>Isopropyl</td>
<td>R-150F</td>
<td></td>
</tr>
<tr>
<td>Methyl</td>
<td>R-150F</td>
<td>R-150F</td>
</tr>
<tr>
<td>Propyl</td>
<td>R-73F</td>
<td>R-73F</td>
</tr>
<tr>
<td>Alum</td>
<td>R-180F</td>
<td></td>
</tr>
<tr>
<td>Aluminum Hydroxide</td>
<td>R-180F</td>
<td></td>
</tr>
<tr>
<td>Aluminum Phosphate</td>
<td>NR</td>
<td></td>
</tr>
<tr>
<td>Aluminum Sulfate</td>
<td>R-180F</td>
<td></td>
</tr>
<tr>
<td>Ammonia Anhydrous</td>
<td>NR</td>
<td></td>
</tr>
<tr>
<td>Ammonia Liquid</td>
<td>R-108F</td>
<td></td>
</tr>
<tr>
<td>Ammonia Nitrate</td>
<td>R-180F</td>
<td></td>
</tr>
<tr>
<td>Ammonia Chloride</td>
<td>R-170F</td>
<td></td>
</tr>
<tr>
<td>Ammonium Fluoride 10%</td>
<td>R-180F</td>
<td>R-180F</td>
</tr>
<tr>
<td>Ammonium Fluoride 20%</td>
<td>R-180F</td>
<td>R-180F</td>
</tr>
<tr>
<td>Ammonium Fluoride 25%</td>
<td>R-73F</td>
<td>R-73F</td>
</tr>
<tr>
<td>Ammonium Hydroxide</td>
<td>R-180F</td>
<td></td>
</tr>
<tr>
<td>Ammonium Nitrate</td>
<td>R-180F</td>
<td></td>
</tr>
<tr>
<td>Ammonium Persulfate</td>
<td>R-180F</td>
<td></td>
</tr>
<tr>
<td>Ammonium Salts</td>
<td>R-180F</td>
<td></td>
</tr>
<tr>
<td>Ammonium Sulfate</td>
<td>R-180F</td>
<td></td>
</tr>
<tr>
<td>Anti-Freeze</td>
<td>R-180F</td>
<td></td>
</tr>
<tr>
<td>Antimony Chloride</td>
<td>R-140F</td>
<td></td>
</tr>
<tr>
<td>Aqua Regia</td>
<td>NR</td>
<td></td>
</tr>
<tr>
<td>Bleach</td>
<td>R-73F</td>
<td></td>
</tr>
<tr>
<td>Boric Acid</td>
<td>R-180F</td>
<td></td>
</tr>
<tr>
<td>Brome</td>
<td>R-140F</td>
<td></td>
</tr>
<tr>
<td>Bromic Acid</td>
<td>R-140F</td>
<td></td>
</tr>
<tr>
<td>Bromine Gas</td>
<td>NR</td>
<td></td>
</tr>
<tr>
<td>Bromine Liquid</td>
<td>NR</td>
<td></td>
</tr>
<tr>
<td>Bromine Water</td>
<td>NR</td>
<td></td>
</tr>
<tr>
<td>Butyl Carbitol</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Butyl Cellosolve</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Calcium Carbonate</td>
<td>R-180F</td>
<td></td>
</tr>
<tr>
<td>Calcium Chlorate</td>
<td>R-180F</td>
<td></td>
</tr>
<tr>
<td>Calcium Chloride</td>
<td>R-180F</td>
<td></td>
</tr>
<tr>
<td>Calcium Dioxide</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Chemical Concentrations</th>
<th>PP</th>
<th>FRPP</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chloric Acid</td>
<td>R-140F</td>
<td>R-140F</td>
</tr>
<tr>
<td>Cocaine</td>
<td>R-180F</td>
<td></td>
</tr>
<tr>
<td>Cocaine</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chlorine Gas, Wet</td>
<td>NR</td>
<td></td>
</tr>
<tr>
<td>Chlorine, Liquid</td>
<td>NR</td>
<td></td>
</tr>
<tr>
<td>Chlorine Water</td>
<td>NR</td>
<td></td>
</tr>
<tr>
<td>Chlorate Bleach 5.5%</td>
<td>NR</td>
<td></td>
</tr>
<tr>
<td>Chromic Acid 5%</td>
<td>R-140F</td>
<td>R-140F</td>
</tr>
<tr>
<td>Chromic Acid 10%</td>
<td>R-140F</td>
<td>R-140F</td>
</tr>
<tr>
<td>Chromic Acid 20%</td>
<td>NR</td>
<td></td>
</tr>
<tr>
<td>Chromic Acid 30%</td>
<td>NR</td>
<td></td>
</tr>
<tr>
<td>Coke Sulfide</td>
<td>R-180F</td>
<td></td>
</tr>
<tr>
<td>Coke Sulfite</td>
<td>R-180F</td>
<td></td>
</tr>
<tr>
<td>Copper Cyanide</td>
<td>R-180F</td>
<td></td>
</tr>
<tr>
<td>Copper Cyanide</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Copper Sulfate</td>
<td>R-180F</td>
<td></td>
</tr>
<tr>
<td>Copper Sulfate</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Corn Oil</td>
<td>R-100F</td>
<td></td>
</tr>
<tr>
<td>Corn Syrup</td>
<td>R-150F</td>
<td></td>
</tr>
<tr>
<td>Cottonseed Oil</td>
<td>R-150F</td>
<td>R-150F</td>
</tr>
<tr>
<td>Copper Nitrate</td>
<td>R-180F</td>
<td></td>
</tr>
<tr>
<td>Copper Nitrate</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cupric Sulfate</td>
<td>R-180F</td>
<td></td>
</tr>
<tr>
<td>Cupric Sulfate</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cyclohexanone</td>
<td>R-68F</td>
<td></td>
</tr>
<tr>
<td>Detergents</td>
<td>R-140F</td>
<td>R-140F</td>
</tr>
<tr>
<td>Dichloroacetic Acid 60%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dichromate Acid 9%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dimethylformamide</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dioxane</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Disodium Phosphate</td>
<td>R-180F</td>
<td></td>
</tr>
<tr>
<td>Ethanol</td>
<td>R-100F</td>
<td></td>
</tr>
<tr>
<td>Ethyl Acetate</td>
<td>R-68F</td>
<td>NR</td>
</tr>
<tr>
<td>Ethyl Ether</td>
<td>R-68F</td>
<td></td>
</tr>
<tr>
<td>Ferric Chloride Anhydrous</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ferric Nitrate</td>
<td>R-180F</td>
<td></td>
</tr>
<tr>
<td>Ferric Sulfate</td>
<td>R-180F</td>
<td></td>
</tr>
<tr>
<td>Formic Acid</td>
<td>R-140F</td>
<td></td>
</tr>
<tr>
<td>Formic Acid</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Formaldehyde</td>
<td>R-180F</td>
<td>R-180F</td>
</tr>
<tr>
<td>Formaldehyde</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Formaldehyde 35%</td>
<td>R-140F</td>
<td>R-140F</td>
</tr>
<tr>
<td>Formaldehyde 50%</td>
<td>R-75F</td>
<td>R-75F</td>
</tr>
<tr>
<td>Formaldehyde 50%</td>
<td>R-75F</td>
<td>R-75F</td>
</tr>
<tr>
<td>Furfural</td>
<td>R-73F</td>
<td></td>
</tr>
<tr>
<td>Furfural</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gas</td>
<td>R-73F</td>
<td></td>
</tr>
<tr>
<td>Gas</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chemical Concentrations</td>
<td>PP</td>
<td>FRPP</td>
</tr>
<tr>
<td>-------------------------</td>
<td>--------</td>
<td>--------------</td>
</tr>
<tr>
<td>Fuel Oil</td>
<td>R-73F</td>
<td></td>
</tr>
<tr>
<td>Gasoline</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Glycerin</td>
<td>R-180F</td>
<td></td>
</tr>
<tr>
<td>Hydrochloric Acid</td>
<td>R-160F</td>
<td>R-160F</td>
</tr>
<tr>
<td>Hydrochloric Acid 10%</td>
<td>R-160F</td>
<td>R-160F</td>
</tr>
<tr>
<td>Hydrochloric Acid 20%</td>
<td>R-160F</td>
<td>R-160F</td>
</tr>
<tr>
<td>Hydrochloric Acid 25%</td>
<td>R-160F</td>
<td>R-160F</td>
</tr>
<tr>
<td>Hydrochloric Acid 37%</td>
<td>R-160F</td>
<td>R-160F</td>
</tr>
<tr>
<td>Hydrosulfuric Acid</td>
<td>R-140F</td>
<td></td>
</tr>
<tr>
<td>Hydrofluoric Acid 10%</td>
<td>R-140F</td>
<td>R-140F</td>
</tr>
<tr>
<td>Hydrofluoric Acid 20%</td>
<td>R-140F</td>
<td>R-140F</td>
</tr>
<tr>
<td>Hydrofluoric Acid 30%</td>
<td>R-140F</td>
<td>R-140F very slight discoloration</td>
</tr>
<tr>
<td>Hydrofluoric Acid 40%</td>
<td>R-140F</td>
<td></td>
</tr>
<tr>
<td>Hydrofluoric Acid 50%</td>
<td>R-73F</td>
<td></td>
</tr>
<tr>
<td>Hydrofluoric Acid 65%</td>
<td>R-73F</td>
<td></td>
</tr>
<tr>
<td>Hydrofluoric Acid 75%</td>
<td>R-73F</td>
<td></td>
</tr>
<tr>
<td>Hydrofluoric Acid 85%</td>
<td>R-73F</td>
<td></td>
</tr>
<tr>
<td>Hydrofluoric Acid 95%</td>
<td>R-73F</td>
<td></td>
</tr>
<tr>
<td>Hydrogen Peroxide 5%</td>
<td>R-180F</td>
<td>R-180F</td>
</tr>
<tr>
<td>Hydrogen Peroxide 10%</td>
<td>R-140F</td>
<td>R-140F</td>
</tr>
<tr>
<td>Hydrogen Peroxide 30%</td>
<td>R-140F</td>
<td>R-104F</td>
</tr>
<tr>
<td>Hydrogen Peroxide 50%</td>
<td>R-68F</td>
<td></td>
</tr>
<tr>
<td>Hydrogen Peroxide 90%</td>
<td>NR</td>
<td></td>
</tr>
<tr>
<td>Isobutyl Alcohol</td>
<td>R-140F</td>
<td></td>
</tr>
<tr>
<td>Isopropyl Alcohol</td>
<td>R-150F</td>
<td></td>
</tr>
<tr>
<td>Ketones</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lemon Oil</td>
<td>NR</td>
<td>R-72F</td>
</tr>
<tr>
<td>Lime (Calcium Oxide)</td>
<td>R-73F</td>
<td></td>
</tr>
<tr>
<td>Linseed Oil</td>
<td>R-180F</td>
<td></td>
</tr>
<tr>
<td>Lye Solution/Sod Hydroxide</td>
<td>R-180F</td>
<td></td>
</tr>
<tr>
<td>Machine Oil</td>
<td>R-73F</td>
<td></td>
</tr>
<tr>
<td>Magnesium Chloride</td>
<td>R-180F</td>
<td></td>
</tr>
<tr>
<td>Magnesium Hydroxide</td>
<td>R-180F</td>
<td></td>
</tr>
<tr>
<td>Magnesium Sulfate</td>
<td>R-180F</td>
<td></td>
</tr>
<tr>
<td>Methane</td>
<td>R-73F</td>
<td></td>
</tr>
<tr>
<td>Methanol</td>
<td>R-140F</td>
<td></td>
</tr>
<tr>
<td>Methyl 'Cellulose'</td>
<td>R-73F</td>
<td></td>
</tr>
<tr>
<td>Methyl Alcohol</td>
<td>R-150F</td>
<td></td>
</tr>
<tr>
<td>Methyl Ethyl Ketone</td>
<td>R-68F</td>
<td></td>
</tr>
<tr>
<td>Methylene Chloride</td>
<td>NR</td>
<td></td>
</tr>
<tr>
<td>Mineral Oil</td>
<td>R-100F</td>
<td>R-100F</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Chemical Concentrations</th>
<th>PP</th>
<th>FRPP</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mono Chlorobenzene</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Motor Oil</td>
<td>R-73F</td>
<td></td>
</tr>
<tr>
<td>Naphthalene</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nickel Chlorde</td>
<td>R-180F</td>
<td></td>
</tr>
<tr>
<td>Nickel Cyanide</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nickel Nitrate</td>
<td>R-180F</td>
<td></td>
</tr>
<tr>
<td>Nitric Acid 10%</td>
<td>R-140F</td>
<td>R-72F very slight discoloration</td>
</tr>
<tr>
<td>Nitric Acid 30%</td>
<td>R-73F</td>
<td>R-73F very slight discoloration</td>
</tr>
<tr>
<td>Nitric Acid 50%</td>
<td>R-73F</td>
<td>R-73F very slight discoloration</td>
</tr>
<tr>
<td>Nitric Acid 70%</td>
<td>NR</td>
<td>NR</td>
</tr>
<tr>
<td>Nitric Acid Concentrated</td>
<td>NR</td>
<td>NR</td>
</tr>
<tr>
<td>Cels, Cotton Seeds</td>
<td>R-150F</td>
<td></td>
</tr>
<tr>
<td>Cels, Mineral</td>
<td>R-100F</td>
<td></td>
</tr>
<tr>
<td>Cels, Vegetable</td>
<td>R-150F</td>
<td>R-150F</td>
</tr>
<tr>
<td>Chrome</td>
<td>R-73F</td>
<td></td>
</tr>
<tr>
<td>Peroxide Acid 40%</td>
<td>NR</td>
<td></td>
</tr>
<tr>
<td>Phenol 90%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Phosphoric Acid 10%</td>
<td>R-180F</td>
<td>R-180F</td>
</tr>
<tr>
<td>Phosphoric Acid 50%</td>
<td>R-180F</td>
<td>R-180F</td>
</tr>
<tr>
<td>Phosphoric Acid 85%</td>
<td>R-180F</td>
<td>R-180F</td>
</tr>
<tr>
<td>Phosphoric Acid 105%</td>
<td>R-73F</td>
<td>R-73F</td>
</tr>
<tr>
<td>Photographic Developer</td>
<td>R-140F</td>
<td>R-104F</td>
</tr>
<tr>
<td>Photographic Solutions</td>
<td>R-150F</td>
<td>R-150F</td>
</tr>
<tr>
<td>Pickle Brine</td>
<td>R-140F</td>
<td></td>
</tr>
<tr>
<td>Pickling Solutions</td>
<td>R-150F</td>
<td></td>
</tr>
<tr>
<td>Plating Solutions</td>
<td>R-150F</td>
<td></td>
</tr>
<tr>
<td>Antimony</td>
<td>R-180F</td>
<td></td>
</tr>
<tr>
<td>Arsenic</td>
<td>R-150F</td>
<td></td>
</tr>
<tr>
<td>Brass</td>
<td>R-180F</td>
<td></td>
</tr>
<tr>
<td>Bronze</td>
<td>R-180F</td>
<td></td>
</tr>
<tr>
<td>Cadmium</td>
<td>R-73F</td>
<td></td>
</tr>
<tr>
<td>Chrome</td>
<td>R-73F</td>
<td></td>
</tr>
<tr>
<td>Copper</td>
<td>R-180F</td>
<td></td>
</tr>
<tr>
<td>Gold</td>
<td>R-73F</td>
<td></td>
</tr>
<tr>
<td>Indium</td>
<td>R-120F</td>
<td></td>
</tr>
<tr>
<td>Iron</td>
<td>R-140F</td>
<td></td>
</tr>
<tr>
<td>Lead</td>
<td>R-140F</td>
<td></td>
</tr>
<tr>
<td>Nickel</td>
<td>R-140F</td>
<td></td>
</tr>
<tr>
<td>Rhodium</td>
<td>R-140F</td>
<td></td>
</tr>
<tr>
<td>Silver</td>
<td>R-180F</td>
<td></td>
</tr>
<tr>
<td>Tin</td>
<td>R-180F</td>
<td></td>
</tr>
<tr>
<td>Zinc</td>
<td>R-150F</td>
<td></td>
</tr>
<tr>
<td>Potash</td>
<td>R-180F</td>
<td></td>
</tr>
</tbody>
</table>
8.2 Hot Water Test

8.2.1 Purpose of Test

The purpose of this test is to insure the coating is resistant to hot water.

8.2.2 Test Procedure

Hot water (190°F to 205°F [88°C to 96°C]) shall be allowed to trickle (with a steady stream and at a rate of not less than 6 ounces [177.44cc] per minute) on the finished surface, which shall be set at an angle of 45°, for a period of five minutes.

8.2.3 Acceptance Level

After cooling and wiping dry, the finish shall show no visible effect from the hot water.

8.3 Impact Test

Not Applicable to Polypropylene

8.4 Paint Adhesion Test

Not Applicable to Polypropylene

8.5 Paint Hardness Test

Not Applicable to Polypropylene

8.6 Dart Impact Test

Not Applicable to Polypropylene

8.7 Edge Delaminating Test

Not Applicable to Polypropylene

8.8 Edge Impact Test

Not Applicable to Polypropylene

8.9 Wear Resistance (Abrasion) Test

Not Applicable to Polypropylene

9.0 Wall, Counter Mounted, and Tall Cabinets

9.1 Description of Test Cabinet

Evaluation shall be conducted on a wall mountable wall cabinet should be double door design cabinet with nominal dimensions as follows: 48" (1,219.2mm) wide, 30" (762mm) high, and 12" (304.8mm) deep. The wall cabinet
shall be manufactured to manufacturers’ standard construction and practices. Door loading procedures are outlined under Section 5.0 (Doors). The wall cabinet will be provided with the manufacturer’s standard number of shelves. Shelves shall be evaluated per Section 7.0 (Shelves). The unit and shelves shall be mounted in a manner recommended by the manufacturer. A visual examination shall be conducted to verify that the configuration and installation comply with these conditions (see Figure 11). Discontinue evaluation if unit is not in compliance or if malfunction is noted.

9.2 Load Test

9.2.1 Purpose of Test

The wall mounted load test will demonstrate the strength of the back of the wall cabinet as well as the joinery of the cabinet and function of doors when the unit is subjected to loads normally expected for laboratory furniture.

9.2.2 Test Procedure

Using sand or shot bags weighing 10 pounds (4.536 Kg) each, load cabinet bottom, each shelf, and top uniformly with 10 pounds (4.536 Kg) per square foot to a maximum of 40 pounds (18.144 Kg) each. Maximum load to any cabinet shall not exceed 480 pounds (217.72 Kg) (a maximum of 200 pounds [90.719 Kg] loaded to each bottom, a minimum of one shelf loaded per Section 7.0, and the top) regardless of the number of shelves.

9.2.3 Acceptance Level

With weights in place, operate doors through full travel to verify normal operation of doors. Remove weights and operate doors to verify normal operation. Verify that there is no significant permanent deflection of cabinet top, cabinet back, cabinet bottom, or shelves. After weights are removed, the cabinet shall show no permanent damage to the cabinet, cabinet bottom, or shelves.

10.0 Tables

10.1 Description of Test Unit

The table for evaluation shall be a standing height, four legged, free standing table. The table shall be nominally 60” (1,524 mm) long, 24” (609.6 mm) deep, and 36” (914.4 mm) high (see: Figure 12). Leg and apron size and construction shall be to manufacturer’s specification. A top of 1” (25.4 mm) thick 37 - 50 pcf medium density fiberboard shall be positioned on the table in a manner recommended by the manufacturer. The top dimensions will be such that it will overhang the cabinet perimeter by 1” (25.4 mm). Its weight shall be included in the test as live load.

Polypropylene tables can be represented by a very large range of styles and designs. Products inclusive in this section of testing are: Free Standing Tables, Desks, Aprons mounted between two fixed areas such as a wall or Casework, Mobile Tables (Free Standing Tables on wheels or casters), Mobile Under Counter Units, Mobile Workstations, Adjustable Tables, Modular Tables, C-Frame Tables, L-Frame Tables, J-Frame Tables, and Tables for systems furniture. These table systems can all be classified as one of three types of tables; Fixed, Free Standing, and Mobile.

10.2 Table Static Load For Free Standing Polypropylene Table

10.2.1 Test Purpose of Test

This test will challenge the table components to loads that are normal for use in a laboratory.
10.2.2 Test Procedure

Load the table top by using solid steel bars (per Section 3.1), each weighing 50 pounds (22.68 Kg), stacked evenly and spaced per Figure 12. These evenly distributed loads should be no less than 300 pounds (136.08 Kg). Include the weight of the working surface as live load.

10.2.3 Acceptance Level

No structural breakage shall result from application of the load. With the full load, the apron rails shall not deflect more than 1/360 of the span of the table and not to exceed 1/8" (3.175mm). In the case of a table with a drawer, the deflection of the rail shall not interfere with the function of the drawer. After the load is removed, inspect the table for structural damage.

10.3 Table Racking

Not Applicable to Polypropylene

Endnotes:

1. This format has been adapted from the BIFMA American National Standard format, X5.5 - 1989.
2. Ibid. p 8.
LABORATORY FURNITURE
CERTIFICATE OF PERFORMANCE

____________________________________________ certifies that its laboratory furniture identified as

(Company Name)

___________________________________, has been tested in conformance with the full requirements

(Test Unit)

of the **SEFA 8-P-2014 Recommended Practices** with results noted below.

Full documentation of the test results is available upon request in a bound report that includes a
detailed description of the test unit and procedures, witnesses results and appropriate drawings or
photographs of the test unit and procedures.

<table>
<thead>
<tr>
<th>TEST</th>
<th>TEST RESULTS PASS/FAIL</th>
<th>TEST</th>
<th>TEST RESULTS PASS / FAIL</th>
<th>TEST</th>
<th>TEST RESULTS PASS / FAIL</th>
</tr>
</thead>
<tbody>
<tr>
<td>4.2</td>
<td>5.3</td>
<td>8.1</td>
<td>See Attached Form</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4.3</td>
<td>6.1</td>
<td>8.2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4.4</td>
<td>6.2</td>
<td>9.2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4.5</td>
<td>6.3</td>
<td>10.2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4.6</td>
<td>6.4</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5.1</td>
<td>6.5</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5.2</td>
<td>7.2</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**COMPANY INFORMATION**

- **Name:**
- **Address:**
- **Telephone:**

**TEST SUPERVISOR INFORMATION**

- **Name:**
- **Title:**
- **Signature:**

**COMPANY OFFICER INFORMATION**

- **Name:**
- **Title:**
- **Date:**
- **Signature:**
# CHEMICAL RESISTANCE TESTING – 8-P-2014

Date of Test: ____________________________  Sample Description: _________________________

Type of Material Coated: ____________________  Coating Type: ______________________________

<table>
<thead>
<tr>
<th></th>
<th>CHEMICAL</th>
<th>RATING</th>
<th>COMMENTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Acetate, Amyl</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Acetate, Ethyl</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Acetic Acid 98%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Acetone</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Acid Dichromate 5%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Alcohol, Butyl</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Alcohol, Ethyl</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Alcohol, Methyl</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>Ammonium Hydroxide 28%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>Benzene</td>
<td></td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>Carbon Tetrachloride</td>
<td></td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>Chloroform</td>
<td></td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>Chromic Acid 60%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>Cresol</td>
<td></td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>Dichloroacetic Acid</td>
<td></td>
<td></td>
</tr>
<tr>
<td>16</td>
<td>Dimethylformamide</td>
<td></td>
<td></td>
</tr>
<tr>
<td>17</td>
<td>Dioxane</td>
<td></td>
<td></td>
</tr>
<tr>
<td>18</td>
<td>Ethyl Ether</td>
<td></td>
<td></td>
</tr>
<tr>
<td>19</td>
<td>Formaldehyde 37%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>20</td>
<td>Formic Acid 90%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>21</td>
<td>Furfural</td>
<td></td>
<td></td>
</tr>
<tr>
<td>22</td>
<td>Gasoline</td>
<td></td>
<td></td>
</tr>
<tr>
<td>23</td>
<td>Hydrofluoric Acid 37%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>24</td>
<td>Hydrofluoric Acid 48%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>25</td>
<td>Hydrogen Peroxide 30%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>26</td>
<td>Iodine, Tincture of Iodine</td>
<td></td>
<td></td>
</tr>
<tr>
<td>27</td>
<td>Methyl Ethyl Ketone</td>
<td></td>
<td></td>
</tr>
<tr>
<td>28</td>
<td>Methylene Chloride</td>
<td></td>
<td></td>
</tr>
<tr>
<td>29</td>
<td>Monochlorobenzene</td>
<td></td>
<td></td>
</tr>
<tr>
<td>30</td>
<td>Naphthalene</td>
<td></td>
<td></td>
</tr>
<tr>
<td>31</td>
<td>Nitric Acid 20%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>32</td>
<td>Nitric Acid 30%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>33</td>
<td>Nitric Acid 70%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>34</td>
<td>Phenol 90%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>35</td>
<td>Phosphoric Acid 85%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>36</td>
<td>Silver Nitrate, Saturated</td>
<td></td>
<td></td>
</tr>
<tr>
<td>37</td>
<td>Sodium Hydroxide 10%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>38</td>
<td>Sodium Hydroxide 20%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>39</td>
<td>Sodium Hydroxide 40%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>40</td>
<td>Sodium Hydroxide, Flake</td>
<td></td>
<td></td>
</tr>
<tr>
<td>41</td>
<td>Sodium Sulfide, Saturated</td>
<td></td>
<td></td>
</tr>
<tr>
<td>42</td>
<td>Sulfuric Acid 33%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>43</td>
<td>Sulfuric Acid 77%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>44</td>
<td>Sulfuric Acid 96%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>45</td>
<td>Sulfuric Acid 77%, and Nitric Acid 70%, equal parts</td>
<td></td>
<td></td>
</tr>
<tr>
<td>46</td>
<td>Toluene</td>
<td></td>
<td></td>
</tr>
<tr>
<td>47</td>
<td>Trichloroethylene</td>
<td></td>
<td></td>
</tr>
<tr>
<td>48</td>
<td>Xylene</td>
<td></td>
<td></td>
</tr>
<tr>
<td>49</td>
<td>Zinc Chloride, Saturated</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**TEST PERFORMED BY:** ______________________________________      **DATE:** ________________
Table Of Contents

Committee Members 275
Foreword 276

Sections

1.0 Scope 277
2.0 Purpose 277
3.0 Definitions 277
3.1 Description of Testing Apparatus

4.0 Base Cabinets 280
4.1 Description of Test Unit
4.2 Cabinet Load Test
  4.2.1 Purpose of Test
  4.2.2 Test Procedure
  4.2.3 Acceptance Level
4.3 Cabinet Concentrated Load Test
  4.3.1 Purpose of Test
  4.3.2 Test Procedure
  4.3.3 Acceptance Level
4.4 Cabinet Torsion
  4.4.1 Purpose of Test
  4.4.2 Test Procedure
  4.4.3 Acceptance Level
4.5 Cabinet Submersion Test
  4.5.1 Purpose of Test
  4.5.2 Test Procedure
  4.5.3 Acceptance Level
4.6 Spill Containment Test
  Not applicable to Wood Casework

5.0 Doors 282
5.1 Door Hinge Test
  5.1.1 Purpose of Test
  5.1.2 Test Procedure
  5.1.3 Acceptance Level
5.2 Door Impact Test
  Not applicable to Wood Casework
5.3 Door Cycle Test
  5.3.1 Purpose of Test
  5.3.2 Test Procedure
  5.3.3 Acceptance Level
5.4 Door Impact Test
  5.4.1 Purpose of Test
  5.4.2 Test Procedure
  5.4.3 Acceptance Level
5.5 Door Cycle Test
  5.5.1 Purpose of Test
  5.5.2 Test Procedure
  5.5.3 Acceptance Level
5.6 Door Impact Test
  5.6.1 Purpose of Test
  5.6.2 Test Procedure
  5.6.3 Acceptance Level
5.7 Door Cycle Test
  5.7.1 Purpose of Test
  5.7.2 Test Procedure
  5.7.3 Acceptance Level

6.0 Drawers 283
6.1 Drawer Static Test
  6.1.1 Purpose of Test
  6.1.2 Test Procedure
  6.1.3 Acceptance Level
6.2 Drawer and Door Pull Test
  Not applicable to Wood Casework
6.3 Drawer Impact Test
  6.3.1 Purpose of Test
  6.3.2 Test Procedure
  6.3.3 Acceptance Level
6.4 Drawer Internal Impact Test
  6.4.1 Purpose of Test
  6.4.2 Test Procedure
  6.4.3 Acceptance Level
6.5 Drawer Cycle Test
  6.5.1 Purpose of Test
  6.5.2 Test Procedure
  6.5.3 Acceptance Level
  6.5.4 Test Procedure
  6.5.5 Acceptance Level

7.0 Shelving 285
7.1 Description of Test Unit
<table>
<thead>
<tr>
<th>7.2</th>
<th>Shelf Load Test</th>
</tr>
</thead>
<tbody>
<tr>
<td>7.2.1</td>
<td>Purpose of Test</td>
</tr>
<tr>
<td>7.2.2</td>
<td>Test Procedure</td>
</tr>
<tr>
<td>7.2.3</td>
<td>Acceptance Level</td>
</tr>
<tr>
<td>8.0</td>
<td>Cabinet Surface Finish Tests</td>
</tr>
<tr>
<td>8.1</td>
<td>Chemical Spot Test</td>
</tr>
<tr>
<td>8.1.1</td>
<td>Purpose of Test</td>
</tr>
<tr>
<td>8.1.2</td>
<td>Test Procedure</td>
</tr>
<tr>
<td>8.1.3</td>
<td>Acceptance Level</td>
</tr>
<tr>
<td>8.2</td>
<td>Hot Water Test</td>
</tr>
<tr>
<td>8.2.1</td>
<td>Purpose of Test</td>
</tr>
<tr>
<td>8.2.2</td>
<td>Test Procedure</td>
</tr>
<tr>
<td>8.2.3</td>
<td>Acceptance Level</td>
</tr>
<tr>
<td>8.3</td>
<td>Impact Test</td>
</tr>
<tr>
<td>Not applicable to Wood Casework</td>
<td></td>
</tr>
<tr>
<td>8.4</td>
<td>Paint Adhesion Test</td>
</tr>
<tr>
<td>Not applicable to Wood Casework</td>
<td></td>
</tr>
<tr>
<td>8.5</td>
<td>Paint Hardness Test</td>
</tr>
<tr>
<td>Not applicable to Wood Casework</td>
<td></td>
</tr>
<tr>
<td>8.6</td>
<td>Dart Impact Test</td>
</tr>
<tr>
<td>Not applicable to Wood Casework</td>
<td></td>
</tr>
<tr>
<td>8.7</td>
<td>Edge Delaminating Test</td>
</tr>
<tr>
<td>Not applicable to Wood Casework</td>
<td></td>
</tr>
<tr>
<td>8.8</td>
<td>Edge Impact Test</td>
</tr>
<tr>
<td>Not applicable to Wood Casework</td>
<td></td>
</tr>
<tr>
<td>8.9</td>
<td>Wear Resistance (Abrasion) Test</td>
</tr>
<tr>
<td>Not applicable to Wood Casework</td>
<td></td>
</tr>
<tr>
<td>9.0</td>
<td>Wall Cabinets, Counter Mounted and Tall Units</td>
</tr>
<tr>
<td>9.1</td>
<td>Description of Test Unit</td>
</tr>
<tr>
<td>9.2</td>
<td>Load Test</td>
</tr>
<tr>
<td>9.2.1</td>
<td>Purpose of Test</td>
</tr>
<tr>
<td>9.2.2</td>
<td>Test Procedure</td>
</tr>
<tr>
<td>9.2.3</td>
<td>Acceptance Level</td>
</tr>
<tr>
<td>10.0</td>
<td>Tables</td>
</tr>
<tr>
<td>10.1</td>
<td>Description of Test Unit</td>
</tr>
<tr>
<td>10.2</td>
<td>Load Test</td>
</tr>
<tr>
<td>10.2.1</td>
<td>Purpose of Test</td>
</tr>
<tr>
<td>10.2.2</td>
<td>Test Procedure</td>
</tr>
<tr>
<td>10.2.3</td>
<td>Acceptance Level</td>
</tr>
<tr>
<td>10.3</td>
<td>Table Racking</td>
</tr>
<tr>
<td>10.3.1</td>
<td>Purpose of Test</td>
</tr>
<tr>
<td>10.3.2</td>
<td>Test Procedure</td>
</tr>
<tr>
<td>10.3.3</td>
<td>Acceptance Level</td>
</tr>
<tr>
<td>Endnotes</td>
<td>290</td>
</tr>
<tr>
<td>Forms</td>
<td>291</td>
</tr>
</tbody>
</table>
SEFA 8-W - Committee Members

Committee Co-Chairs
Brant Kelly - Diversified Woodcrafts
Wayne Cathey - ICI Scientific

Kewaunee Scientific
Mott Manufacturing
Sheldon Laboratory Systems, Inc.
Foreword

SEFA Profile

The Scientific Equipment and Furniture Association (SEFA) is an international trade association comprised of manufacturers of laboratory furniture, casework, fume hoods and members of the design and installation professions. The Association was founded to promote this rapidly expanding industry and improve the quality, safety and timely completion of laboratory facilities in accordance with customer requirements.

SEFA Recommended Practices

SEFA and its committees are active in the development and promotion of Recommended Practices having domestic and international applications. Recommended Practices are developed by the association taking into account the work of other standard writing organizations. Liaison is also maintained with government agencies in the development of their specifications.

SEFA's Recommended Practices are developed in and for the public interest. These practices are designed to promote a better understanding between designers, architects, manufacturers, purchasers, and end-users and to assist the purchaser in selecting and specifying the proper product to meet the user’s particular needs. SEFA's Recommended Practices are periodically updated. The Recommended Practices are numbered to include an annual suffix which reflects the year that they were updated. SEFA encourages architects to specify these Recommended Practices as follows: “SEFA 8W-2016”.

SEFA Glossary of Terms

SEFA has developed a Glossary of Terms (SEFA 4-2010) for the purpose of promoting a greater understanding between designers, architects, manufacturers, purchasers and end users. The terms defined by SEFA are frequently used in contracts and other documents, which attempt to define the products to be furnished or the work involved. The Association has approved this Glossary in an effort to provide uniformity among those who use these terms. Where a specific Recommended Practice contains definitions which differ from those in the Glossary of Terms, then the definitions in the specific Recommended Practice should be used.

SEFA encourages all interested parties to submit additional terms or to suggest any changes to those terms already defined by the Association. The definitions should be used to help resolve any disputes that may arise or to incorporate the applicable terms in any contract or related documents.

SEFA Disclaimer

SEFA uses its best effort to promulgate Recommended Practices for the benefit of the public in light of available information and accepted industry practices. SEFA does not guarantee, certify or assure the safety or performance of any products, components, or systems tested, installed, or operated in accordance with SEFA Recommended Practices or that any tests conducted under its Recommended Practices will be non-hazardous or free from risk. SEFA encourages the use of third party independent testing where appropriate.

Note: Testing as described in this document must be performed and documented by a SEFA-approved third party testing facility. See Page 34 of the SEFA Desk Reference 5th Edition Version 2.0, or visit us at SEFALABS.COM for the most current list of SEFA-approved test labs.
1.0 Scope

The scope of this document is intended to provide manufactures, specifiers, and users tools for evaluating the safety, durability, and structural integrity of laboratory grade wood furniture and complimentary items. This document is inclusive of casework (base units, wall mounted units, counter mounted units, tall units, tables and, shelving systems). Casework, tables, and shelving manufactured for laboratory use should be subjected to the tests and procedures outlined below.

Wood laboratory grade casework shall consist of base cabinets, wall cabinets, counter mounted cabinets, tall cabinets, tables, and shelving.

Aggregate test results may vary by manufacturer. Procedures for testing performance criteria shall be as outlined in this document and results made available upon request. It is assumed that the test model reflects the performance criteria for all products. However there may be certain door/drawer configurations and/or sizes outside the test unit configuration identified that may not meet certain parts of this test. A test unit has been identified in this document with the sole purpose of obtaining continuity of procedures and results in a scientific format.

Great care should be exercised when heavy loads are applied to the cabinet and appropriate safety precautions taken to insure safety of testing personnel. Properly trained personnel should perform all tests. SEFA assumes no liability for damage or injury as a result of conducting these tests.

The acceptance levels are based on the cumulative field experience and laboratory testing of SEFA members based on actual needs of laboratories. This is a performance-based document. Specifications proscribing specific materials, hardware, finishes, workmanship or construction may or may not meet acceptance levels of this document. If proscriptive components of the specifications conflict with compliance of this document then the Architectural proscribed elements take precedent.

Testing as outlined in this document must be performed and documented by a SEFA-approved independent third party testing facility.

2.0 Purpose

The purpose of this document is to describe the distinguishing performance characteristics of laboratory grade wood furniture and complimentary items. Furniture shall be of a type specifically designed and manufactured for installation and use in a laboratory.

Although aggregate test results may vary from manufacturer to manufacturer, procedures for testing performance criteria shall be as outlined in this document and results made available upon request. It is assumed that the test model reflects the performance criteria for all products regardless of construction, size, or style used. A test unit has been identified in this document with the sole purpose of obtaining continuity for procedures and results in a scientific format.

3.0 Definitions

Acceptance Levels - The acceptance level for each performance criteria is based on the cumulative experience of actual field testing and laboratory results of SEFA members. Acceptance levels describe the expected outcome of each test procedure.

ANSI/BIFMA - ANSI is the American National Standards Institute. Approval of an American National Standard requires verification by ANSI that the requirements for due process, consensus, and other criteria for approval have been met by the standards developer. BIFMA is the Business and Institutional Furniture Manufacturer's Association, an association of manufacturers of desk products and the like.

Apparatus - A machine or group of machines and accessories.

Arithmetic Mean - A number obtained by dividing the sum of a set of quantities by the number of quantities in a set; average.

Base Cabinets - A base cabinet is a storage device consisting of two ends, a back, a face and may or may not include a top or top frame. The face may be open, to access the storage area, or may be outfitted with one or more drawers and/or doors. A base cabinet is always placed on the floor and normally supports a surface. The top surface is normally no more than 42” (1,067mm) off the floor surface.

Best Practices - When given a choice of grade, the “best practice” is to select one that offers a well defined degree of control over the quality of workmanship, materials, and installation of a project. SEFA-8 Recommended Practices are written from a view of high quality laboratory furniture.

Cabinet Depth (Deep) - Given a front, bottom, two sides, and a top, the cabinet depth is a measure of the side of the cabinet, in its normal upright position, from the outside back to the outside front excluding doors and door fronts.

Cabinet Height (High) - Given a front, bottom, two sides, and a top, the cabinet height is a measure of the side of the cabinet, in its normal upright position, from the bottom edge of the side to the top, excluding any surface.

Cabinet Width (Wide) - Given a front, bottom, two sides, and a top, the cabinet width is a measure of the front of the cabinet in its normal upright position from one side to the other.

Casework - Base and wall cabinets, display fixtures, and storage shelves. The generic term for both “boxes” and special desks, reception counters, nurses stations and the like. Generally includes the tops and work surfaces.

Chase (Plumbing Area) - Space located behind the back of the base cabinet used to house plumbing or electric lines.

Composition Core - A core material using particleboard, MDF, or agrifiber product.

Combination Unit - A base unit of the type that has both door(s) and drawer(s).

Counter Mounted Cabinet - A counter mounted cabinet is a wall cabinet (usually with a height of approximately 48” [1,219mm] and is typically mounted on the work surface or shelf, as in a reagent shelf).

Cupboard (Door Unit) - That portion of the cabinet with no drawer(s) that may be enclosed by doors.

Drawer - A sliding storage box or receptacle opened by pulling out and closed by pushing in.

Free Standing - Requiring no support or fastening to other structures.

Hardware - Items such as screws, pulls, hinges, latches, locks, and drawer slides used in the construction of casework.

Joinery – The junction of two pieces intended to be permanently connected.

Laboratory Furniture - Furniture designed and manufactured for installation and use in a laboratory.

Latch - A piece of hardware designed to hold a door closed.

Leveling Screws (Levelers) - Threaded components designed to allow adjustment of the cabinet vertically as needed for leveling.

Medium Density Fiberboard (MDF) - Wood particles reduced to fibers in a moderate pressure steam vessel combined with a resin, and bonded together under heat and pressure.

Nominal Dimensions - Not all cabinet manufacturers produce product to the identical dimensions. All dimensions given in this document are accurate to within five percent, which is considered nominal.

Particleboard - A panel or core product composed of small particles of wood and wood fiber that are bonded together with synthetic resin adhesives in the presence of heat and pressure.
Permanent Damage - Destruction to material or joinery that would require repair in order to return to its original state.

Permanent Deformation - Deflection that has exceeded the limits of the product, thus changing the original shape of the product.

Permanent Deterioration - Erosion or corrosion of material such that the component will never return to its original shape.

Permanent Failure - See “permanent damage.”

Plywood - The term plywood is defined as a panel manufactured of three or more layers (plies) of wood or wood products (veneers or overlays and/or core materials), generally laminated into a single sheet (panel). Plywood is separated into two groups according to materials and manufacturing, hardwood plywood and softwood plywood. Except for special constructions, the grain of alternate plies is at right angles.

Pulls - Articles of hardware used to grasp and open/close the door or drawer (see also hardware).

Rack Resistance - The ability of a product to resist stresses that tend to make the product distort and the drawers to become misaligned.

Rail - A horizontal member extending from one side of the cabinet to the other.

Reagent - A substance used because of its chemical or biological activity.

Removable Back - A panel located on the inside back of the base cabinet, which is removable in order to gain access to utilities.

Stainless Steel - Iron based alloys containing more chromium than the 12% necessary to produce passivity (less reactive), but less than 30%.

Submersion - Covered with water.

Tables - An article of furniture having a flat, horizontal surface supported by one or more support members (legs), and a frame (apron).

Tall Cabinet (Full Height Unit) - A tall cabinet is a storage device that consists of two ends, a top and bottom panel, a back and a face. The face may be open to access the storage area or may be outfitted with one or more drawers and/or door(s). A tall cabinet is always placed on the floor and is nominally 84” (2,134mm) high.

Torsion – A force acting at a distance which tends to twist or rotate an object or cabinet.

Uniformly Distributed – A force applied evenly over the area of a surface.

Unobstructed Entry - A cabinet is deemed to be unobstructed if access to the entire storage area is completely without obstacle.

Upright Position - A cabinet oriented in its intended position.

Veneer Core Plywood – A panel or core product composed of an odd number of thin veneer layers that are bonded together with an adhesive. Except for special constructions, the grain of alternate plies is at right angles. All plies shall be combinations of species, thickness, density, and moisture content to produce a balanced panel. All inner plies, except the innermost ply, shall occur in pairs.

Wall Cabinet - A wall cabinet is a storage device consisting of two ends, a back, a top, bottom, and a face. The face may be open to access the storage area or may be outfitted with one or more door(s). The wall cabinet usually does not include a drawer. A wall cabinet is always mounted on a vertical surface such as a wall, a divider, panel or some other vertical structure. A wall cabinet is usually less than 48” (1,219mm) high.

Work Surface - A normally horizontal surface used to support apparatus at a convenient height above the floor. Work surfaces are normally positioned atop a base cabinet or table structure.

3.1 Description of Testing Apparatus

Solid Steel Bar - A square solid steel bar 2 1/2" (63mm) square, 28 1/4" (717mm) long, weighing 50 pounds (22.679 Kg).
Sand or Shot Bag (10 pounds [4.545 Kg]) - A bag of plastic or cloth with the approximate dimensions 10 9/16” (268mm) x 11” (279mm) as in typical “gallon size re-closable stor-age bags.” Filled with enough sand or shot so that contents weigh 10 pounds (4.545 Kg).

Sand Bag (20 pounds [9.071 Kg]) - Two 10 pound (4.545 Kg) sand bags bound together.

Shot Bag (100 lbs. [45.359 Kg]) - A plastic or cloth bag of sufficient size to contain 100 pounds (45.359 Kg) of shot.

Cycling Mechanism - Per ANSI BHMA 156.9.-2003

Steel Rod - A 2” (51mm) diameter by 12” (305mm) long rod, approximately 10 pounds (4.535 Kg) in weight.

Hot Water - To be considered “hot water,” the temperature of the water must be between 190º F to 205º F (88º C to 96º C).

One Pound Ball - Solid steel sphere approximately 2” (51mm) in diameter.

Hardwood Corner Block - A block of hardwood 2” (51mm) square by 1” (25.4mm) high.

**4.0 Base Cabinets**

**4.1 Description of Test Cabinet**

The base cabinet shall be a combination of cupboard and drawer per Figure 1. The base cabinet shall be 48” +/- 1” (1219.2mm +/- 25.4mm) wide, 36” +/-1” (914.4mm +/- 25.4mm) high, and 22” +/-1” (558 mm +/- 25.4mm) deep. Cabinet dimensions do not include drawer or door front thickness. The drawer shall be above the cupboard, full width and approximately one-fourth the height of the cabinet’s face opening. Drawer shall be a minimum of 18” (457.2mm) deep outside dimension. When slides are used for drawers, slides shall be a minimum of 18” (457.2mm) deep. Cupboard shall be double-door design and provide unobstructed entry into the cabinet interior with the doors open. The unit shall contain one adjustable shelf.

Before conducting the test, a visual examination shall be conducted to verify that the unit configuration and setup conditions are appropriate. Operate doors and drawer. Doors should be free moving and latch properly. Inspect the unit for dimensions and note the fit of doors and drawers to the cabinet body. Open and close the drawer. The drawer should be free moving and function as specified by the manufacturer. Discontinue evaluation if unit is not in compliance or if malfunction is noted.
Although aggregate test results may vary from manufacturer to manufacturer, procedures for testing performance criteria shall be as outlined in this document and results made available upon request. It is assumed that the test model reflects the performance criteria for all products regardless of construction, size, or style used. A test unit has been identified in this document with the sole purpose of obtaining continuity of procedures and results in a scientific format.

4.2 Cabinet Load Test -

4.2.1 Purpose of Test

The cabinet load test will challenge the structural integrity and load bearing capability of the cabinet construction. This test will demonstrate the ability of the cabinet to support heavy applied loads. This is not intended to test the functional characteristics of the cabinet under heavy loads.

4.2.2 Test Procedure

Verify that the cabinet is level. Remove drawer and open doors for testing purpose. Load the cabinet top by using 2000 pounds (907.184 Kg) of solid steel bars (per Section 3.1) stacked four high and spaced per Figure 2. After 24 hours, unload the cabinet.

4.2.3 Acceptance Level

The cabinet will have no permanent failure.

4.3 Cabinet Concentrated Load Test

4.3.1 Purpose of Test

The purpose of this test is to challenge the functional characteristics of the cabinet when subjected to a concentrated load on the center of the cabinet top.

4.3.2 Test Procedure

Using solid weights or 10 pound (4.535 Kg) sand bags (per Section 3.1), apply a total of 200 pounds (90.718 Kg) to the top of the cabinet along the cabinet centerline (see Figure 3). Operate doors and drawers.

4.3.3 Acceptance Level

Door and drawer operation shall be normal under condition of test load. There shall be no signs of permanent deformation to front rail, cabinet joinery, doors, or drawers.

4.4 Cabinet Torsion

4.4.1 Purpose of Test

This test will evaluate the structural integrity of the cabinet construction when subjected to a torsional load.
4.4.2 Test Procedure

The cabinet shall be tested in its normal upright position, raised not less than four-inches off the floor and supported on rear and one front corner. The area of support under the cabinet shall be located not more than 6” (152.4mm) in from each supported corner. Secure the cabinet diagonally from the unsupported corner with seven solid steel bars per Section 3.1 (350 pounds (158.757 Kg) of weight), on the top of the cabinet to prevent overturning. Apply four solid steel bars (200 pounds [90.718 Kg] of weight) to the unsupported corner for a period of 24 hours (see Figure 4). Remove weight and place cabinet on the floor in its normal upright position. Observe cabinet joinery. Level the cabinet and measure the face and back of the cabinet across the diagonal corners.

4.4.3 Acceptance Level

When returned to normal position, the operation of the cabinet shall be normal, and there will be no permanent damage. The difference between the two measurements taken from measuring the diagonal corners shall be no more than 1/8” (3.175mm).

4.5 Cabinet Submersion Test

4.5.1 Purpose of Test

This test will demonstrate the ability of a cabinet to resist wicking of moisture from the floor. Only units that rest on the floor or a unit where the base is within 2” (50.8mm) of the floor should be subjected to this test.

4.5.2 Test Procedure

The material thickness along the perimeter of the cabinet shall be measured on 6” (152.4mm) increments. Record the thickness of the material to be submerged in water. Calculate the arithmetic mean of the data taken. Place the entire test cabinet in its upright position such that the cabinet is submerged in a pan filled with 2” (50.8mm) of water. After 4 hours, remove the unit from the water and immediately measure the thickness of the material at the same points measured initially. Calculate the new arithmetic mean. After the unit has been allowed to dry, inspect for other damage.

4.5.3 Acceptance Level

The cabinet will show no permanent deformation or deterioration. Increase in thickness shall not exceed ten percent of the initial mean measurements.

4.6 Cabinet Spill Containment Test

Not Applicable to Wood Casework.

5.0 Doors

5.1 Door Hinge Test

5.1.1 Purpose of Test

This test will demonstrate the durability of the door, door attachment and its hardware (hinge leaf, screws, etc.) to an applied load of 200 pounds (90.72 Kg).

5.1.2 Test Procedure

Remove the shelf for this test. With unit and top set as described in Section 4.1, add sufficient weight to the top in order to prevent overturning. With cabinet door opened 90-degrees, hang a sling made up of two 100 pound (45.359 Kg) weights (shot bags or solid weights) over top of the door at a point 12” (304.8mm) out from the hinge centerline (see Figure 5). Slowly move door
through two full cycles of the hinge at 160-degree arc. Remove weight and swing door through its full intended range of motion and close door.

5.1.3 Acceptance Level
The open door shall withstand a load of 200 pounds (90.72 Kg) when applied at a point 12"(304.8mm) from the hinge centerline without permanent damage. Operation of the door, after test shall show no significant permanent damage that will cause binding of the door or hinges or that will adversely affect operation of the catch.

5.2 Door Impact Test
Not Applicable to Wood Casework

5.3 Door Cycle Test

5.3.1 Purpose of Test
This test will demonstrate the durability of the door hinge hardware to withstand 100,000 cycles as a reliable measure for longevity).

5.3.2 Test Procedure
This test shall be in conformance to the ANSI test procedure A156.9, Grade 1, requirements for cycle testing of doors. A cycling mechanism shall swing door 90-degrees. Door shall operate for 100,000 cycles with a speed not greater than 15 cycles per minute.

5.3.3 Acceptance Level
Door shall operate for the full cycle period without deterioration that will significantly affect the function of the door. The door shall operate freely without binding.

6.0 Drawers

6.1 Drawer Static Test

6.1.1 Purpose of Test
This test will demonstrate the ability to support a point load given to the front of the drawer and will challenge the drawer suspension system and the attachment of the drawer head to the drawer.

Fig. 6 Base Cabinet Drawer Static Load Test Configuration

Note: Load top sufficient to prevent tipping of base cabinet.
6.1.2 Test Procedure

With unit and top set as described in Section 4.1, add sufficient weight to the top in order to prevent overturning. Open the drawer to 13” (330.2mm) of travel and hang 150 pounds (68.03 Kg) from the drawer head at the centerline of the drawer for five minutes. Remove the weight and operate the drawer through the full cycle.

6.1.3 Acceptance Level

There shall be no interference with the normal operation of the drawer and the drawer head should remain tightly fastened to the drawer.

6.2 Drawer and Door Pull Test

Not Applicable to Wood Casework.

6.3 Drawer Impact Test

6.3.1 Purpose of Test

This test will demonstrate the resistance to impact of the drawer bottom.

6.3.2 Test Procedure

Remove drawer; support each corner with 2”x2”x1” (50.8 x 50.8 x 25.4 mm) supports. Drop a 10 pound (4.545 Kg) sand or shot bag from a height of 24” (609.6 mm) into the bottom of the drawer at the center of the width of the drawer. Remove the sand or shot bag.

6.3.3 Acceptance Level

No damage or breakout of the drawer bottom.

6.4 Drawer Internal Rolling Impact Test

6.4.1 Purpose of Test

This test will evaluate the strength of the drawer head, bottom, and back as a result of opening and closing the drawer with a rolling load.

6.4.2 Test Procedure

Position the drawer on a table at a 45-degree angle per Figure 7. Place a 2” (50.8mm) diameter by 12” (304.8mm) long steel rod (approximately 10 pounds [4.545 Kg]) 13” (330.2mm) from the target impact area such that the rod will roll freely to impact the back of the drawer. Subject the back to three impacts and reverse the drawer to subject the front to three additional impacts.

6.4.3 Acceptance Level

The drawer shall show no permanent damage. All joinery shall be intact and the drawer, when replaced in the unit, shall operate normally. Minor scratches and dents are acceptable.

6.5 Drawer Cycle Test

Mechanical and Non-Mechanical drawer suspension systems are addressed in this Section. When specifiers require SEFA-8 Wood certified cabinets yet fail to stipulate a drawer suspension system then certification will default to cabinets certified with mechanical suspension systems.

6.5.1 Purpose of Test (Mechanical Suspension System)

This test is intended to test the drawer’s operation under full load. To be considered Laboratory Grade Wood Casework, the mechanical drawer slides must be rated at a minimum, ANSI/BHMA A156.9 Grade 1.
6.5.2 Test Procedure (Mechanical Suspension System)

Mechanical Suspension Systems – A dynamic load of 75 pounds (34.019 Kg) shall be uniformly distributed in the drawer (using ten 7 ½ pound (3.401 Kg) sand or shot bags per Section 3.1). Measure force required to activate the drawer. Operate over the full range of motion without engaging bumpers, stops or self-closing features for 50,000 cycles at a rate not to exceed 8 - 12 cycles per minute.

6.5.3 Acceptance Level (Mechanical Suspension System)

The drawer shall operate freely without evidence of binding. The force required to open and close loaded drawer shall not be greater than 8 pounds to activate.*

6.5.4 Test Procedure - (Non-Mechanical Suspension System)

Non-Mechanical Suspension Systems – A dynamic load of 200 pounds (907.184) shall be uniformly distributed in the drawer (using twenty 10 pound (4.535 Kg) sand or shot bags per Section 3.1).

The drawer shall operate freely without evidence of binding. With 200 pounds (90.718 KG) of evenly distributed load in the drawer the force required to open and close drawer shall not be greater than 40 pounds (18.143 Kg) to activate. With 75 pounds (34.019 Kg) of evenly distributed load in the drawer the force required to open and close drawer shall not be greater than 15 pounds (6.803 Kg) to activate.*

*The American’s with Disabilities Act (ADA) requires a force no greater than five pounds to activate hardware. The load rating in this document is intended only for testing conditions where loads challenge the durability of the hardware. Under actual conditions, drawer loading should be reduced to levels that result in compliance with ADA as applicable.

7.0 Shelving

7.1 Description of Test Cabinet

Wood shelving shall be tested using the following procedure. The shelves to be tested are as described in section 4.1 and 9.1 “Description of Test Cabinet”.

7.2 Shelf Load Test

7.2.1 Purpose of Test

This test will demonstrate the ability of a shelf and its mounting hardware to support loads of 40 pounds (18.143 Kg) per square foot, not to exceed 200 pounds (90.718 Kg).

7.2.2 Test Procedure

A shelf shall be mounted in a manner in which it is designed. Measure the distance from the underside of the shelf to a reference point perpendicular to the center of the shelf. Use shot or sand bags weighing 10 pounds (4.535 Kg) each. Unless otherwise specified, load the shelf uniformly to 40 pounds (18.14 kg) per square foot of shelf area to a maximum of 200 pounds (90.71 Kg). Measure the deflection of the shelf by measuring the distance to the reference point and calculating the difference between the two measurements. Record data and remove the load.
7.2.3 Acceptance Level

Different materials will perform differently to the loads based on the Modulus of Elasticity of the material and the cross section moment of inertia for the shape of the material. Longer shelves will support less loads than shorter shelves. The allowable maximum deflection of a shelf is 1/180 of the span and not in excess of .25" (6.35mm).

8.0 Cabinet Surface Finish Tests

8.1 Chemical Spot Test

Users should consider the chemical and staining agents that might be used near the laboratory casework. Common guidelines can be found by referring to: The casework manufacturer printed data for chemical and stain resistance, NEMA LD3-2000 for wood product chemical resistance, ASTM D3023 and ASTM C1378 for stain resistance or the most current versions. Because chemical and stain resistance is affected by concentration, time, temperature, humidity, housekeeping and other factors, it is recommended that users test samples in their actual environment with the substances they use.

8.1.1 Purpose of Test

The purpose of the chemical spot test is to evaluate the resistance a finish has to chemical spills.

Note: Many organic solvents are suspected carcinogens, toxic and/or flammable. Great care should be exercised to protect personnel and the environment from exposure to harmful levels of these materials.

8.1.2 Test Procedure

Sample substrate will be red oak, rift-cut veneer without stain underneath the coating. Panels to be finished according to finishing supplier’s guidelines and in accordance to casework manufacturer’s standard procedures.

Obtain one sample panel measuring 14" x 24" (355.6mm x 609.6mm). The received sample to be tested for chemical resistance as described herein. Place panel on a flat surface, clean with soap and water and blot dry. Condition the panel for 48-hours at 73º +/- 3ºF (23º +/- 2ºC) and 50 +/- 5% relative humidity or the currently accepted guideline set by ASTM. Test the panel for chemical resistance using forty-nine different chemical reagents by one of the following methods.

Method A - Test volatile chemicals by placing a cotton ball saturated with reagent in the mouth of a 1-oz. (29.574cc) bottle and inverting the bottle on the surface of the panel.

Method B - Test non-volatile chemicals by placing five drops of the reagent on the surface of the panel and covering with a 24mm watch glass, convex side down.

For both of the above methods, leave the reagents on the panel for a period of one hour. Wash off the panel with water, clean with detergent and naptha, and rinse with deionized water. Dry with a towel and evaluate after 24-hours at 73º +/- 3ºF (23º +/- 2ºC) and 50 +/- 5% relative humidity, or the currently accepted guideline set by ASTM using the following rating system.

Level 0 - No detectable change.
Level 1 - Slight change in color or gloss.
Level 2 - Slight surface etching or severe staining.
Level 3 - Pitting, cratering, swelling, or erosion of coating. Obvious and significant deterioration.

Note: Percentages are by volume.

8.1.3 Acceptance Level

Range of results is provided to establish the acceptable range for a Laboratory Grade Finish. Results will vary from manufacturer to manufacturer due to differences in finish formulations. Laboratory grade finishes shall result in no more than four (4) Level 3 conditions. Individual test results, for the specified 49 reagents, will be verified with the established third party, independent SEFA 8 test submittal form. Suitability for a given application is dependent upon the chemicals used in a given laboratory.
8.2 Hot Water Test

8.2.1 Purpose of Test

The purpose of this test is to insure the coating is resistant to hot water.

8.2.2 Test Procedure

Hot water (190°F to 205°F [88°C to 96°C]) shall be allowed to trickle (with a steady stream and at a rate of not less than 6 ounces [177.44cc] per minute) on the finished surface, which shall be set at an angle of 45°, for a period of five minutes.

8.2.3 Acceptance Level

After cooling and wiping dry, the finish shall show no visible effect from the hot water.

8.3 Ball Impact Test

Not Applicable to Wood Casework.

8.4 Paint Adhesion Test

Not Applicable to Wood Casework.

8.5 Paint Hardness Test

Not Applicable to Wood Casework.

8.6 Dart Impact Test

Not Applicable to Wood Casework.

8.7 Edge Delaminating Test

Not Applicable to Wood Casework.

8.8 Edge Impact Test

Not Applicable to Wood Casework.

8.9 Wear Resistance (Abrasion) Test

Not Applicable to Wood Casework.
9.0 Wall, Counter Mounted and Tall Units

9.1 Description of Test Unit

Evaluation shall be conducted on a wall mounted cabinet with nominal dimensions as follows: 48” (1,219.2mm) +/- 1” wide, 30” (762mm) +/- 1” high, and 12” (304.8mm) +/- 1” deep. The wall cabinet shall be manufactured to manufacturers’ standard construction and practices. The wall cabinet shall be open wall cabinet and have two (2) shelves. Shelves shall be evaluated per Section 7.0 (Shelving). The unit and shelves shall be mounted in a manner recommended by the manufacturer. A visual examination shall be conducted to verify that the configuration and installation comply with these conditions. Discontinue evaluation if unit is not in compliance or if malfunction is noted.

9.2 Wall Cabinet Load Test

9.2.1 Purpose of Test

The wall mounted load test will demonstrate the strength of the back of the wall cabinet as well as the joinery of the cabinet and function of doors when the unit is subjected to loads normally expected for laboratory furniture.

9.2.2 Test Procedure

Using sand or shot bags weighing 10 pounds (4.55 Kg) each, load cabinet bottom, each shelf, and top uniformly with 40 pounds (18.18 Kg) per square foot to a maximum of 200 pounds (90.91 Kg) each. Maximum load to any cabinet shall not exceed 600 pounds (272.73 Kg) (a maximum of 200 pounds [90.91 Kg] loaded to each bottom, a minimum of one shelf loaded per Section 7.0, and the top) regardless of the number of shelves. Test to be performed with doors closed.

9.2.3 Acceptance Level

With weights in place, after a period of 24 hours, operate doors through full travel to verify normal operation of doors. Remove weights and operate doors to verify normal operation. Verify that there is no significant permanent deflection of cabinet top, cabinet back, cabinet bottom, or shelves. After weights are removed, the cabinet shall show no permanent damage to the cabinet, cabinet bottom, or shelves.

10.0 Tables

10.1 Description of Test Unit

The table for evaluation shall be a standing height, four legged, freestanding table. The table shall be nominally 60” (1,524mm) long, 24” (609.6mm) deep, and 36” (914.4mm) high (see Figure 13). Leg and apron size and construction shall be to manufacturer’s specification. A top of 1” (25.4mm) thick 37 - 50 pcf medium density fiberboard shall be mounted on the table in a manner recommended by the manufacturer. The top dimensions will be such that it will overhang the cabinet perimeter by 1”. Its weight shall be included in the test as live load.
A very large range of styles and designs can represent tables. Products inclusive in this section of testing are: Free Standing Tables, Desks, Aprons mounted between two fixed areas such as a wall or Casework, Mobile Tables (Free Standing Tables on wheels or casters), Mobile Under Counter Units, Mobile Workstations, Adjustable Tables, Modular Tables, C-Frame Tables, L-Frame Tables, J-Frame Tables, and Tables for systems furniture. These table systems can all be classified as one of three types of tables: Fixed, Free Standing, and mobile. See Figure 10.

10.2 Table Static Load

10.2.1 Purpose of Test

This test will challenge the table components to loads that are normal for use in a laboratory.

10.2.2 Test Procedure

Load the table top by using solid steel bars (per Section 3.1), each weighing 50 pounds (22.679 Kg), stacked evenly and spaced per Figure 11. Load the table to the manufacturer's recommended live load*. These evenly distributed loads should be no less than 300 pounds (136.077 Kg) for mobile, 600 pounds (272.155 Kg) for free standing and 2000 pounds (907.184 Kg) for fixed. Include the weight of the working surface as live load.

* Table load will vary considerably. Factors impacting live load capability include the size of the table, material, amount of drawers and book compartments, glide or caster load rating. Contact manufacturer for live load specifications. See Fig 11.

10.2.3 Acceptance Level

No structural breakage shall result from application of the load. With the full load, the apron rails shall not deflect more than 1/360 of the span of the table and not to exceed 1/8” (3.175mm). In the case of a table with a drawer, the deflection of the rail shall not interfere with the function of the drawer. After the load is removed, inspect the table for structural damage.

10.3 Table Racking

10.3.1 Purpose of Test

This test will demonstrate the structural integrity of the table construction when subjected to a racking load. Most racking failures occur upon dragging an unloaded table across a floor. The ability of a table to resist a racking load will indicate less damage to the structure. The following tests were based on and adapted from ANSI/BIFMA X5.5-1989 American National Standard for Office Furnishings “Desk Products-Tests.” Adjustments have been made to better accommodate the specific applications of tables used in laboratories.
10.3.2 Test Procedure

The table shall have a common two-by-four wood rail clamped on the centerline of the top parallel to the ends of the table. The table shall then be positioned at 45º, with one pair of legs on the floor and the other raised and supported (see Figure 12). To prevent the table from tipping over, attach a cable to the end rail of the table and to the wall. The attachment of the cable at the wall must be equal to or less than the height of the attachment at the table. The table shall then have 250 pounds (113.398 Kg) of weight (five 50-pound (22.679 Kg) bars) placed on its top and held in place by the two-by-four wood rail. The unit shall remain in this position for seventy-two hours. The unit shall be lowered without shock to the leveled surface and the general operation of the drawers shall be evaluated.

10.3.3 Acceptance Level

When returned to normal position, the operation of the table shall be normal, and there will be no permanent damage.

Endnotes:

1 This format has been adapted from the BIFMA American National Standard format, X5.5 - 1989.
2 Ibid. p 8.
8 Webster’s Ninth New Collegiate Dictionary, 1988, p 980.
LABORATORY FURNITURE
CERTIFICATE OF PERFORMANCE

________________________________________ certifies that its laboratory furniture identified as (Company Name)___________________________________, has been tested in conformance with the full requirements of the SEFA 8-W-2016 Recommended Practices with results noted below.

Full documentation of the test results is available upon request in a bound report that includes a detailed description of the test unit and procedures, witnesses results and appropriate drawings or photographs of the test unit and procedures.

<table>
<thead>
<tr>
<th>TEST</th>
<th>TEST RESULTS PASS/FAIL</th>
<th>TEST</th>
<th>TEST RESULTS PASS / FAIL</th>
<th>TEST</th>
<th>TEST RESULTS PASS / FAIL</th>
</tr>
</thead>
<tbody>
<tr>
<td>4.2</td>
<td>6.3</td>
<td>10.2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4.3</td>
<td>6.4</td>
<td>10.3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4.4</td>
<td>6.5 Mechanical</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4.5</td>
<td>6.5 Non-Mechanical</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5.1</td>
<td>7.1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5.3</td>
<td>8.1 See Attached Form</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6.1</td>
<td>8.2</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**COMPANY INFORMATION**
Name: 
Address: 

**TEST SUPERVISOR INFORMATION**
Name: 
Title: 
Signature: 

**COMPANY OFFICER INFORMATION**
Fax: 
Name: 
Title: 
Date: 
Signature:
## CHEMICAL RESISTANCE TESTING – 8-W-2016

Date of Test: ____________________________ Sample Description: _________________________

Type of Material Coated: ____________________ Coating Type: ______________________________

**Rating Scale:**
- Level 0 – No Detectable Change
- Level 1 – Slight Change in Color or Gloss
- Level 2 – Slight Surface Etching or Severe Staining

<table>
<thead>
<tr>
<th>#</th>
<th>CHEMICAL</th>
<th>RATING</th>
<th>COMMENTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Acetate, Amyl</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Acetate, Ethyl</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Acetic Acid 98%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Acetone</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Acid Dichromate 5%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Alcohol, Butyl</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Alcohol, Ethyl</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Alcohol, Methyl</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>Ammonium Hydroxide 28%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>Benzene</td>
<td></td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>Carbon Tetrachloride</td>
<td></td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>Chloroform</td>
<td></td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>Chromic Acid 60%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>Cresol</td>
<td></td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>Dichloroacetic Acid</td>
<td></td>
<td></td>
</tr>
<tr>
<td>16</td>
<td>Dimethylformamide</td>
<td></td>
<td></td>
</tr>
<tr>
<td>17</td>
<td>Dioxane</td>
<td></td>
<td></td>
</tr>
<tr>
<td>18</td>
<td>Ethyl Ether</td>
<td></td>
<td></td>
</tr>
<tr>
<td>19</td>
<td>Formaldehyde 37%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>20</td>
<td>Formic Acid 90%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>21</td>
<td>Furfural</td>
<td></td>
<td></td>
</tr>
<tr>
<td>22</td>
<td>Gasoline</td>
<td></td>
<td></td>
</tr>
<tr>
<td>23</td>
<td>Hydrofluoric Acid 37%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>24</td>
<td>Hydrofluoric Acid 48%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>25</td>
<td>Hydrogen Peroxide 30%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>26</td>
<td>Iodine, Tincture of</td>
<td></td>
<td></td>
</tr>
<tr>
<td>27</td>
<td>Methyl Ethyl Ketone</td>
<td></td>
<td></td>
</tr>
<tr>
<td>28</td>
<td>Methylene Chloride</td>
<td></td>
<td></td>
</tr>
<tr>
<td>29</td>
<td>Monochlorobenzene</td>
<td></td>
<td></td>
</tr>
<tr>
<td>30</td>
<td>Naphthalene</td>
<td></td>
<td></td>
</tr>
<tr>
<td>31</td>
<td>Nitric Acid 20%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>32</td>
<td>Nitric Acid 30%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>33</td>
<td>Nitric Acid 70%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>34</td>
<td>Phenol 90%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>35</td>
<td>Phosphoric Acid 85%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>36</td>
<td>Silver Nitrate, Saturated</td>
<td></td>
<td></td>
</tr>
<tr>
<td>37</td>
<td>Sodium Hydroxide 10%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>38</td>
<td>Sodium Hydroxide 20%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>39</td>
<td>Sodium Hydroxide 40%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>40</td>
<td>Sodium Hydroxide, Flakes</td>
<td></td>
<td></td>
</tr>
<tr>
<td>41</td>
<td>Sodium Sulfide, Saturated</td>
<td></td>
<td></td>
</tr>
<tr>
<td>42</td>
<td>Sulfuric Acid 33%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>43</td>
<td>Sulfuric Acid 77%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>44</td>
<td>Sulfuric Acid 90%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>45</td>
<td>Sulfuric Acid 77%, and</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Nitric Acid 70%, equal parts</td>
<td></td>
<td></td>
</tr>
<tr>
<td>46</td>
<td>Toluene</td>
<td></td>
<td></td>
</tr>
<tr>
<td>47</td>
<td>Trichloroethylene</td>
<td></td>
<td></td>
</tr>
<tr>
<td>48</td>
<td>Xylene</td>
<td></td>
<td></td>
</tr>
<tr>
<td>49</td>
<td>Zinc Chloride, Saturated</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Scientific Equipment & Furniture Association
Recommended Practices

SEFA 9-2010 -
Ductless Enclosures

SEFA World Headquarters
65 Hilton Avenue
Garden City, NY  11530

Tel: 516-294-5424
Fax: 516-294-2758
www.sefalabs.com
# Table of Contents

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Committee Members</td>
<td>296</td>
</tr>
<tr>
<td>Foreword</td>
<td>297</td>
</tr>
<tr>
<td>Sections</td>
<td>298</td>
</tr>
<tr>
<td>1.0 Scope</td>
<td></td>
</tr>
<tr>
<td>2.0 Purpose</td>
<td></td>
</tr>
<tr>
<td>3.0 Ductless Hood Defined</td>
<td>298</td>
</tr>
<tr>
<td>3.1 Ductless Hood Scope of Application Defined</td>
<td></td>
</tr>
<tr>
<td>4.0 Ductless Hood – Types</td>
<td>298</td>
</tr>
<tr>
<td>4.1 Ductless Hood Filtration Categories</td>
<td></td>
</tr>
<tr>
<td>4.1.1 DH I</td>
<td></td>
</tr>
<tr>
<td>4.1.2 DH II</td>
<td></td>
</tr>
<tr>
<td>4.1.3 DH III</td>
<td></td>
</tr>
<tr>
<td>4.2 Manufacturer Approved Applications/Misuse Prevention - As Manufactured</td>
<td></td>
</tr>
<tr>
<td>4.2.1 Manufacturer’s Handbook</td>
<td></td>
</tr>
<tr>
<td>4.2.2 Manufacturer Approved Application Questionnaire Form</td>
<td></td>
</tr>
<tr>
<td>SEFA 9-A</td>
<td></td>
</tr>
<tr>
<td>4.2.3 Filter Saturation Detection</td>
<td></td>
</tr>
<tr>
<td>DH II/III</td>
<td></td>
</tr>
<tr>
<td>4.2.4 Face Velocity Monitoring</td>
<td></td>
</tr>
<tr>
<td>DH II/III</td>
<td></td>
</tr>
<tr>
<td>4.3 SEFA 9 Benchmark Testing – As Manufactured</td>
<td></td>
</tr>
<tr>
<td>4.3.1 Filtration and Containment</td>
<td></td>
</tr>
<tr>
<td>4.3.2 Independent Testing and Validation</td>
<td></td>
</tr>
<tr>
<td>4.4 Markings</td>
<td></td>
</tr>
<tr>
<td>5.0 Ductless Hoods – As used</td>
<td>302</td>
</tr>
<tr>
<td>5.1 Safe Work Practices</td>
<td></td>
</tr>
<tr>
<td>5.2 Recommended Usage Precautions</td>
<td></td>
</tr>
<tr>
<td>5.2.1 DH I</td>
<td></td>
</tr>
<tr>
<td>5.2.2 DH II</td>
<td></td>
</tr>
<tr>
<td>5.2.3 DH III</td>
<td></td>
</tr>
<tr>
<td>5.3 Manufacturer Approved Applications – As Used</td>
<td></td>
</tr>
<tr>
<td>5.3.1 Manufacturer Approved Application Response Form</td>
<td></td>
</tr>
<tr>
<td>SEFA 9-A</td>
<td></td>
</tr>
<tr>
<td>5.4 Dedicated Usage/Change of Application Procedures/Monitoring</td>
<td></td>
</tr>
<tr>
<td>5.5 Dedicated Usage Markings–As used</td>
<td></td>
</tr>
<tr>
<td>5.6 Contaminated Filter Handling Procedures</td>
<td></td>
</tr>
<tr>
<td>6.0 Ductless Hoods-As Installed</td>
<td>304</td>
</tr>
<tr>
<td>6.1 Test Protocol</td>
<td></td>
</tr>
<tr>
<td>6.2 Frequency of Testing</td>
<td></td>
</tr>
<tr>
<td>7.0 Reference Organizations</td>
<td>305</td>
</tr>
<tr>
<td>7.1 Filtration and Exposure Limitations</td>
<td></td>
</tr>
<tr>
<td>7.2 Containment</td>
<td></td>
</tr>
<tr>
<td>SEFA Form 9-A</td>
<td>307</td>
</tr>
</tbody>
</table>
SEFA 9 — Ductless Enclosures Committee Members

Co-Chairs
Kevin Gilkison - Labconco Corporation
Kevin McGough - AirClean Systems

AirClean Systems
Air Control
Air Master Systems
BSA Life Structures
Exposure Control Technologies
HEMCO Corp.
Kewaunee Scientific Corp.
Labconco Corporation
Lab Crafters, Inc.
Foreword

SEFA Profile

The Scientific Equipment and Furniture Association (SEFA) is an international trade association comprised of manufacturers of laboratory furniture, casework, fume hoods and members of the design and installation professions. The Association was founded to promote this rapidly expanding industry and improve the quality, safety and timely completion of laboratory facilities in accordance with customer requirements.

SEFA Recommended Practices

SEFA and its committees are active in the development and promotion of Recommended Practices having domestic and international applications. Recommended Practices are developed by the association taking into account the work of other standard-writing organizations. Liaison is also maintained with government agencies in the development of their specifications.

SEFA's Recommended Practices are developed in and for the public interest. These practices are designed to promote a better understanding between designers, architects, manufacturers, purchasers, and end-users and to assist the purchaser in selecting and specifying the proper product to meet the user's particular needs. SEFA's Recommended Practices are periodically updated. The Recommended Practices are numbered to include an annual suffix which reflects the year that they were updated. SEFA encourages architects to specify these Recommended Practices as follows: “SEFA 9-2010”.

SEFA Glossary of Terms

SEFA has developed a Glossary of Terms (SEFA 4-2010) for the purpose of promoting a greater understanding between designers, architects, manufacturers, purchasers and end users. The terms defined by SEFA are frequently used in contracts and other documents, which attempt to define the products to be furnished or the work involved. The Association has approved this Glossary in an effort to provide uniformity among those who use these terms. Where a specific Recommended Practice contains definitions which differ from those in the Glossary of Terms, then the definitions in the specific Recommended Practice should be used.

SEFA encourages all interested parties to submit additional terms or to suggest any changes to those terms already defined by the Association. The definitions should be used to help resolve any disputes that may arise or to incorporate the applicable terms in any contract or related documents.

SEFA Disclaimer

SEFA uses its best effort to promulgate Recommended Practices for the benefit of the public in light of available information and accepted industry practices. SEFA does not guarantee, certify, or assure the safety or performance of any products, components, or systems tested, installed, or operated in accordance with SEFA Recommended Practices or that any tests conducted under its Recommended Practices will be non-hazardous or free from risk. SEFA encourages the use of third party independent testing where appropriate.

Note: Testing as described in this document must be performed and documented by a SEFA-approved third party testing facility. See Page 34 of the SEFA Desk Reference 5th Edition Version 2.0, or visit us at SEPALABS.COM for the most current list of SEFA-approved test labs.
1.0 Scope

These SEFA Recommended Practices provide a comprehensive single source of knowledge pertaining to laboratory Ductless Hoods. Since the Ductless Hood is a re-circulating filtration device, which is not integral to the laboratory ventilation system, these practices will primarily address issues relating to filtration, product usage, feasibility, safety and limitations as well as manufacturer usage recommendations and manufacturer responsibility.

2.0 Purpose

To allow for the correct use and application of ductless hoods.

The purpose of these Recommended Practices is to establish manufacturer's requirements for the general design and testing of Ductless Hoods as well as guidelines and procedures for the correct specification, use, maintenance and testing of Ductless Hoods. These requirements, guidelines and procedures are for Ductless Hoods that are used to protect personnel from harmful exposure to contaminants generated within the ductless hood. The individual manufacturer recommendations must be followed for each specific application and usage.

3.0 Ductless Hood Defined

A ductless hood, a/k/a (but not limited to) Ductless Fume Hood, Ductless Filtering Fume Enclosure, Portable Hood, Carbon Filtered Enclosure, Enclosure for Toxins using Recirculating Air Filtration (E.T.R.A.F.) is an enclosure designed for the handling of contaminants, which limits the propagation toward the operator and other personnel of such contaminants. Typically, it is not attached to any external exhaust system. A Ductless Hood is equipped with its own independent ventilation system which forces the contaminated air to travel through a filter and recirculates it within the room.

3.1 Ductless Hood Scope of Application Defined

Ductless Hoods do not have the same scope of application as standard laboratory Fume Hoods, Biological Safety Cabinets, or potent compound hoods. Ductless Hoods are only suitable for use with identified, manufacturer approved applications.

4.0 Ductless Hood – Types

4.1 Ductless Hood Filtration Categories

4.1.1 DH I

A ductless hood equipped with a filtration device designed to control non-toxic chemicals, nuisance odors, particulates.

4.1.2 DH II

A ductless hood capable of meeting all DH I requirements, and equipped with a filtration device designed to filter manufacturer approved toxic contaminants up to filter break through only. A DH II ductless hood is not designed to provide secondary containment beyond primary filter break through.

4.1.3 DH III

A ductless hood capable of meeting all DH II requirements, and equipped with a filtration device designed to filter manufacturer approved toxic contaminants beyond primary filter break through by providing secondary back-up protection. Once the primary filter break through point has been detected a DH III ductless hood should be designed to provide a period of time to continue and end an ongoing experiment with its secondary back-up filter system. The secondary filter must be of the same type of media and efficacy, as the primary filter.
4.2 Manufacturer Approved Applications / Misuse Prevention - As Manufactured

4.2.1 Manufacturer’s Performance Information

A Ductless Hood regardless of Category is limited by the capabilities of its filtration system. The manufacturer’s performance information, must be supplied for each DH II and III Ductless Hood, and is designed to clearly outline manufacturer approved applications and usage limitations and shall at least include the following:

A definition of Ductless Hood Categories identical to the one outlined in these Recommended Practices.

A copy of the SEFA 9 test results for the “as manufactured” performance test for both filtration and containment as per section 4.3 validated by an independent recognizable third party, showing retention capacities in grams/ounces for each compatible filter type. For example, this would be the retention capacity of the filter as stated by the manufacturer prior to releasing 50% of the TLV/PEL of the toxic contaminant for DH II and 1% of the TLV/PEL of the toxic contaminant for DH III.

4.2.2 Manufacturer Approved Application Questionnaire Form SEFA 9-A

Prior to approving usage, a qualified specialist or department within the manufacturer or supplier of the Ductless Hood should review all applications and determine for each the compatibility or incompatibility of the ductless hood by using form SEFA 9-A. Form SEFA 9-A is a standardized form designed to cover all pertinent questions regarding the intended usage of a ductless hood, and is necessary to determine and subsequently approve or deny usage.

The following list represents the minimum information to be provided by the customer:

- Date
- Customer’s company name and address
- Customer contact name and phone#
- Intended application including list all equipment to be used inside hood
- Name of each material planned on being used and Chemical ID i.e., CAS#, EN#, etc.,
- Amount of each material
- Concentration of material i.e., full strength, dilute, percentage
- Frequency and duration of the application
- Temperature of material
- Type of container used and is the container covered or open
- Evaporation Rate
- Maximum potential spill volume
- Truthful and accurate statement

Completed by Manufacturer—Refer to § 5.3.1.

In the case of a manufacturer/supplier approved application, the resulting document shall provide all necessary information, as detailed in “As Used” section 5.3, for the correct use and maintenance of the ductless hood.

4.2.3 Filter Saturation Detection DH II/III

DH II and III Ductless Hoods require constant monitoring of filter saturation breakthrough and should be designed with a continuous audible and visual automatic saturation detection monitoring device able to detect all manufacturer approved toxic contaminants. The efficacy of the device should be such that when break through occurs, test measurements taken downstream from the filter must not exceed 50% of the TLV of the manufacturer approved toxic contaminant(s) for DH II Ductless Hoods and 1% of the TLV of the manufacturer approved contaminant(s) for DH III Ductless Hoods. The means necessary to insure the proper functioning and manual verification of the automatic filter saturation detection device should also be provided. The frequency of the verification shall be recommended by the manufacturer, but be the responsibility of the EH&S officer.

4.2.4 Face Velocity Monitoring DH II / III

A permanent face velocity monitoring device should be incorporated within all DH II and III ductless hoods. The monitoring device
should be calibrated by a face velocity traverse as recommended in ASHRAE 110-95 using the average as the set point. To ensure proper performance as recommended by the manufacturer testing should be performed at least annually.

4.3 SEFA 9 Benchmark Testing – As Manufactured

4.3.1 Filtration and Containment

DH I:

Nuisance odors only. No testing required.

DH II and III:

If manufacturers require more than one filter media type to perform the benchmark test chemicals, testing should then be performed using the appropriate filter media type.

Benchmark - Testing procedure:

This test is applicable to only Class II and Class III hoods. It is not intended for Class I type hoods used for nuisance and non toxic odors.

Calibration of testing equipment— please refer to ASHRAE 110-95 for calibration guidelines.

Hood setup and face velocity measurements— the ductless hood shall be setup per manufacturer’s recommendations in a location that has average cross draft of less than 30 fpm when measured 18 inches out from the face of the hood at the left and right side of the sash opening. Face velocity measurements are made by establishing an imaginary grid pattern equally divided in the vertical and horizontal positions and taking velocity readings at each grid point. Readings should be taken each second for a period of 30 seconds and averaged. Determine the average of each grid position. The measured deviation shall not vary more than +/- 20% of the overall average. Cross draft and airflow velocity measurements are made using a hot wire calibrated anemometer. Test each model (Type Test) or after modification to unit or filter. The hood face velocity shall be set by the ductless hood manufacturer. (Refer to SEFA 1-2010 Section 4.3 and/or ANSI/ASHRAE 110-1995 6.2 Face Velocity Measurements or most current version).

Flow Visualization — discharge smoke from a smoke stick along the walls and work surface of the hood six inches back from the front of the unit. Smoke shall be carried to the back or top of the hood and be exhausted with little reverse movement. Particular attention shall be given to the corners. At no time shall smoke escape out the hood, except through the filtered exhaust. If smoke does escape out the front of the hood the hood fails the test. The filter seals and other areas of the hood where contaminate could escape shall be under negative pressure.

Containment Testing. (Refer to ASHRAE 110-1995 or most current version for specific details.) — place an exhaust duct with canopy style connection from an exhaust system with variable control over the exhaust port of the ductless hood. The exhaust system shall be set to exhaust a greater CFM than the ductless hood requires to keep any contaminates from the exhaust from leaking into the test room. Once the external exhaust system is operating, face velocity readings shall be retaken and match those previously taken with the external exhaust system off. If the face velocities have changed, reduce the exhaust system CFM to where there is no effect on the hood face velocities. The exhaust on the system must be great enough to keep the exhaust plenum area negative, but not so strong that the face velocities on the hood are affected.

Use an ITI Leak Meter or other continuous reading instrument specific for sulfur hexafluoride gas capable of 0.01 ppm detection or less.

Position the manikin in front of the hood, in a sitting position with the sampling probe 1.5” above the bottom of the sash and 3” out from the bottom sash edge. The sash shall be placed in the “designed sash position.” The tracer gas test is run with the ejector placed 6 inches behind the plane of the face opening in three different positions. These positions are 12 inches from the right and left sides of the hood and at the center line of the hood. Release sulfur hexafluoride tracer gas at the rate of 4 liters/minute. Determine tracer gas concentration using leak meter or
other continuous reading instrument. Remove the manikin and scan the perimeter of the sash and airfoil of the hood using the leak meter probe, holding the probe approximately one inch from the hood opening. No leakage of tracer gas shall be greater than an average of 0.05 ppm in any position. Refer to ASHRAE 110-1995 for instrumentation, ejector construction and method details.

Filter Efficiency and Adsorption Capacity Tests — with the ductless hood setup per manufacturer's recommendation install the appropriate filter(s) for your test. Turn on the system and allow the hood to stabilize per manufacturer’s instructions. Record relative humidity and temperature of laboratory before and after test. Temperature should be between 18°C to 22°C and relative humidity between 40% to 60%.

Evaporate one of the following listed chemicals at the indicated rates:

<table>
<thead>
<tr>
<th>Chemical Family</th>
<th>TLV</th>
<th>Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>HCL</td>
<td>5 ppm</td>
<td>100 ppm</td>
</tr>
<tr>
<td>Diethyl Amine</td>
<td>10 ppm</td>
<td>50 ppm</td>
</tr>
<tr>
<td>Isopropyl</td>
<td>400 ppm</td>
<td>500 ppm</td>
</tr>
<tr>
<td>Toluene</td>
<td>100 ppm</td>
<td>150 ppm</td>
</tr>
</tbody>
</table>

The evaporation rate required is determined by calculating the mass rate of chemical needed to mix with the hood air flow (CFM) during test to create the indicated flow rates.

Suitable ways of evaporation are free surface evaporation without heat, heating the chemical in a container on a hot plate or addition of the chemical into a metal or ceramic cup heated by a hot plate using a peristaltic or other high precision positive displacement pump set to the required mass flow rate. Control the evaporation temperature to where degradation of the chemical does not occur. Example of evaporation temperature for toluene would be 140° C. Determine the evaporation rate of the chemical by weighing the container(s) before and after the evaporation, with an appropriate precision balance or scale and noting weight change per unit time. When using a pumping device to pump the chemical into a heated container the flow rate of the chemical into the container determines the evaporation rate. When using a hot plate for evaporation caution must be taken to keep the hot plate temperature below the flash point of the chemical to prevent a fire or explosion or degradation of the chemical. Do not use open flame to heat the containers. If additional chemicals are tested and sufficient mass cannot be evaporated to reach a challenge level of TLV or greater, a lower challenge level may be permitted as long as it is the maximum level which can be reasonably obtained and the conditions of the test are recorded.

Monitor the concentration of the test chemical in the room, in the hood, before the filter and in the exhaust stream past the filter(s) under test by using a gas chromatograph, mass spectrometer, FTIR analyzer or PID detector. Manufacture is to determine sampling points. Exhaust sampling point must be located in an area that represents the actual concentration of the exhaust. Complete mixing at the sampling point must be validated. The instrumentation used shall have a minimum detection level of 1% of the TLV or less. In the case where hydrochloric acid is tested an ion chromatograph or FTIR is recommended. Colorimetric detection tubes do not have the necessary resolution to accurately determine the concentration of the chemicals and shall only be used for the determination of HCL, if FTIR or an ion chromatograph is not available. Continuous sampling of the exhaust for acid detection can be made by using a small pump to pull the exhaust sample through a general acid colorimetric tube for the purpose of acid detection, at the rate of approximately 1.5 l/min. When the general acid colorimetric tube begins to turn pink begin sampling exhaust with HCL acid colorimetric tube, 1-10 ppm, to determine the exhaust concentration. Follow manufactures sampling recommendation when sampling with the HCL acid 1-10 ppm tube.

Exhaust air from the hood must be sampled at 15 minute time intervals. For sampling of HCL acid using colorimetric tubes, sampling must begin two hours before the end point of the test is achieved. For hoods which incorporate a secondary filter means, the exhaust of the primary filter bed ONLY will be sampled, not the exhaust of the hood itself. Continue evaporation and exhaust
sampling until chemical concentration equals the inlet concentration or the TLV, whichever is lower. For each data point, record or calculate the mass of chemical evaporated as well as chemical concentration levels in the sampled air streams. Sample and record room concentrations at a sampling point one foot out from the center point of the sash. In cases where the time of testing goes beyond 8 hours, the hood and test apparatus shall be turned off and left in a stagnant mode until the next testing period. During this stagnant mode, the hood shall be disconnected from any active exhaust systems to prevent airflow through the filters. At the beginning of the next test period record and graph all data. Be certain chemical containers are sealed to prevent evaporation. The test output shall be a table or graph of the mass of the test chemical evaporated plotted as the x-axis vs. the concentration in ppm of the chemical concentration found in the hood exhaust on the y-axis. Conditions of the test are to be provided on the graph or separate list that includes temperature and humidity of the test room, CFM and face velocity, evaporation rate, grade and concentration of the chemical, current listed TLV, start and stop of the test, amount of filter media and type, method of evaporation, inlet concentration and total test time. The name and model number of the unit tested is also to be provided with the report.

4.3.2 Independent testing and validation

The manufacturers’ benchmark testing as described in 4.3.1 shall be validated by an independent recognizable third party. Manufacturers should include a copy of the third party testing in their technical manual.

4.4 Markings

Ductless Hoods should be clearly identified with the words “DUCTLESS HOOD” prominently displayed in large letters on the front of the product in order to differentiate them from conventional ducted Fume Hoods.

DH ratings, identified in this work practice as DH I, II and III, should also be prominently displayed in large letters on the front of the product, along with reference to SEFA 9. The DH I Ductless Hood label should contain a message noting their inability to provide protection for anything other than nuisance odorous compounds. The DH II Ductless Hood label should contain a message requiring the immediate suspension of usage at the time of saturation detection.

An area on the Ductless Hood should be provided in plain view for the placement of form SEFA 9-A. If removed the form shall let the following words appear: “NOT RECOMMENDED FOR USE WITHOUT CURRENT APPLICATION APPROVAL FORM SEFA 9-A IN PLACE.”

A sticker stating the recommended sash/door position should be placed on the enclosure. The label should also indicate if the ductless hood is only able to achieve SEFA 9 containment compliance in a specific position. The filtration device type and name should appear in plain view and be easily identifiable by the operator.

5.0 Ductless Hoods – As used

5.1 Safe Work Practices

Operators should use Ductless Hoods in accordance with their organization’s safety guidelines and have a clear understanding of the limitations and capabilities of their Ductless Hood prior to usage. Always refer to completed SEFA 9A prior to usage. Also refer to current SEFA 1-2010 Section 6 for applicable general safe usage recommendations.

5.2 Recommended Usage Precautions

In general, Ductless Hoods are not recommended for usage with unknown chemicals or reactions. Ductless Hood usage should be limited to manufacturer approved applications only (section 5.3).

5.2.1 DH I

DH I Ductless Hoods should only be recommended for use with applications that would normally be performed on the open bench
without protection. DH I Ductless Hoods should not be used with toxic contaminants.

5.2.2 DH II

DH II Ductless Hoods should not be recommended for use unless their application has been pre-approved by the manufacturer/supplier using form SEFA 9-A, which should be posted on the ductless hood at all times in accordance with section 5.3.

DH II Ductless Hoods should not be recommended for use with toxic contaminants that do not have a reported TLV/PEL value.

DH II Ductless Hoods should only be recommended for use with applications where continuous monitoring and detection of filter break through is available.

Since a DH II Ductless Hood provides protection only up to filter break through, its use must be suspended once filter break through detection occurs. Refer to section 4.2.3

5.2.3 DH III

DH III Ductless Hoods should not be recommended for use unless their application has been pre-approved by the manufacturer/supplier using form SEFA 9-A in accordance with section 5.3.

DH III Ductless Hoods should only be recommended for use with applications where permanent monitoring and detection of filter break through is available. Refer to section 4.2.3

5.3 Manufacturer Approved Applications – As Used

The manufacturer or supplier of the Ductless Hood should approve all applications prior to usage. The Ductless Hood operator should limit their usage to the manufacturer approved applications only. The notion of dedicating a Ductless Hood to a specific manufacturer approved application plays a crucial role in insuring safe Ductless Hood usage. The formal response form SEFA 9-A given to the Ductless Hood operator is a necessary document as it represents an agreed upon understanding of correct dedicated use between the supplier and the operator. It is therefore required for Ductless Hood manufacturers/suppliers to integrate within their organization the means necessary to scientifically approve each potential application.

It is the responsibility of the end user to advise the manufacturer of the Ductless Hood and gain the approval of all applications in writing prior to usage.

5.3.1 Manufacturer Approved Application Questionnaire Form SEFA 9-A

Form SEFA 9-A is a standardized form designed to answer all pertinent questions regarding the intended usage of a ductless hood and ultimately guide the end-user in the correct use of their ductless hood. In the case of a manufacturer/supplier approved application, form SEFA 9-A should be posted in the space provided on the ductless hood at all times. Response form SEFA 9-A should include:

• The application approval reference number;
• The approved application and corresponding list of approved toxic substances;
• The approval date;
• The approved filter type;
• The estimated filter life;
• The filtration system date of first use and estimated date of replacement;
• Information regarding the automatic filter saturation detection system;
• The model and serial number of the ductless hood;
• A warning dedicating the ductless hood to the approved application only;
• A warning for Category II ductless hoods indicating the need to stop the procedure immediately following filter saturation detection;

5.4 Dedicated Usage / Change of Application Procedures / Monitoring

Ductless Hood operators should limit their usage to manufacturer approved applications only, as shown on Form SEFA 9-A.
Operators shall obtain prior written re-approval from the manufacturer every time an application varies in any way from the initial approved usage. There is no difference between a change of application and a new usage qualification.

5.5 **Dedicated Usage Markings – As used**

Manufacturer approved application form SEFA 9-A should be posted in the place provided on the ductless hood at all times. A current form shall replace the previous form every time an application varies from the initial manufacturer approved application.

5.6 **Contaminated Filter Handling Procedures**

The waste disposal method for your contaminated filters depends on the type of toxic contaminant(s) introduced into the filter by the Ductless Hood operator. The operator should contact the individual or department within their organization responsible for controlling the disposal of all hazardous waste. The filter should be removed in accordance with local ordinances.

6.0 **Ductless Hoods – As Installed**

6.1 A test protocol must be provided by the manufacturer for DHII and DHIII hoods to verify that the unit is functioning to manufacturer’s specifications. The “As Installed” test protocol must be sufficient to validate manufacturer’s claims for face velocity, base containment, filter sealing and instantaneous filtration, as well as verifying the display of face velocity and emissions monitoring systems.

Manufacturer’s may make available, either for sale or loan, testing kits and instruction manuals to allow users or third party certifiers to carry out test protocols in the field.

The test protocol must include:

1. Test procedure for verifying face velocity of hood. Procedure should include requirements for testing the recommended face velocity settings if face velocity adjustment is provided by the control system.

2. Test procedure for verifying base containment using smoke stick or other form of flow visualization.

3. Test procedure for verifying filter seals and instantaneous removal of contaminant by primary filter pack for DHII and DHIII hoods and secondary filter pack for DHIII hoods.

   (a) If surrogate chemical challenge is specified, the recommended chemical must be of low toxicity and readily available for use, i.e. isopropyl alcohol or similar. Chemical surrogate should be of same chemical family as the chemical for which the hood was specified, if possible.

   (b) Test should not require a large amount of chemical to be adsorbed, as not to shorten filter life.

   Test procedure to verify operation of all monitoring systems.

   (a) Face velocity monitors may be verified simultaneously with actual face velocity test above.

   (b) Test procedure should contain provisions for verifying alarm functions.

6.2 **Frequency of Testing**

The Manufacturer should specify the events which would trigger the need of such testing. At a minimum, the tests should be conducted:

After initial installation but BEFORE first use.
After major repair or refurbishment of hood.
After relocation of hood.

It is the responsibility of the user facility EH&S officer to establish test plans to verify proper function during the life of the unit.
7.0 Reference Organizations

7.1 Filtration and Exposure Limitations

(USA) ANSI/AIHA Z9.5 - 2003  
(USA) NIOSH Pocket Guide to Chemical Hazards  
(USA) OSHA Regulation 1910:1450  
(CANADA) CSA Z316.5 -1994  
(FRANCE) AFNOR NFX 15-211  
(AUSTRALIAN) Re-circulating Fume Cabinets AS 2243.9

7.2 Containment

(USA) ASHRAE 110-95  
(FRANCE) AFNOR NFX 15-210  
(U.K.) XP X 15-203  
(GERMANY) DIN 12 924
**SEFA FORM 9-A - Application Questionnaire**

(See SEFA 9-2010 §4.2.2)

| Customer: | | |
| Address: | | |
| Contact: | Phone: | Date: |

**Description of Application:** *(Customer to describe the process to be performed inside the hood including all equipment to be used inside hood)*

---

**Completed by Customer**  
**Completed by Manufacturer**

<table>
<thead>
<tr>
<th>Chemical ID (ln, CAS#, EN#, etc.)</th>
<th>Amount</th>
<th>Concentration</th>
<th>Frequency/Duration</th>
<th>Temperature</th>
<th>Container Type—Covered, Open</th>
<th>Evaporation Rate</th>
<th>Maximum Potential Spill Volume</th>
<th>Exp Reference</th>
<th>Exp Limit</th>
<th>Limit Type</th>
<th>MSDS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

I, ________________________________, in my capacity as _______________________________ of _______________________________, certify to the best of my knowledge that all data and information submitted in this Application/SEFA Form 9-A, is truthful and accurate and that no material fact has been omitted.

(Signature) __________________________ (Date) __________________________
**SEFA FORM 9-A—Manufacturer’s Response**

(See SEFA 9-2010 § 5.3.1)

<table>
<thead>
<tr>
<th>Manufacturer’s Name:</th>
<th>Approval Reference No.:</th>
</tr>
</thead>
</table>
| Model and Serial No.:| ___________________________

<table>
<thead>
<tr>
<th>Address:</th>
</tr>
</thead>
</table>
| ___________________________

<table>
<thead>
<tr>
<th>Manufacturer’s Approved Filtration Category:</th>
<th>DH I</th>
<th>DH II</th>
<th>DH III</th>
</tr>
</thead>
</table>
| Filtration System Date of First Use: | ___________________________
| Estimated Replacement Date: |

<table>
<thead>
<tr>
<th>Phone:</th>
</tr>
</thead>
</table>
| ___________________________

<table>
<thead>
<tr>
<th>Approved Filter Type:</th>
</tr>
</thead>
</table>
| ___________________________

<table>
<thead>
<tr>
<th>Estimated Filter Life:</th>
</tr>
</thead>
</table>
| ___________________________

**Approved Application:** (Manufacturer to provide information regarding the automatic filter saturation detection system as well as the list of approved toxic substances)

---

**Application:**

- □ Approved
- □ Disapproved

<table>
<thead>
<tr>
<th>Print Name:</th>
</tr>
</thead>
</table>
| ___________________________

<table>
<thead>
<tr>
<th>Signature:</th>
</tr>
</thead>
</table>
| ___________________________

<table>
<thead>
<tr>
<th>Date:</th>
</tr>
</thead>
</table>
| ____________

---

**WARNINGS**

- DUCTLESS HOOD OPERATORS SHALL LIMIT THEIR USAGE TO MANUFACTURER APPROVED APPLICATIONS AS SHOWN ON THIS SEFA FORM 9A.

- OPERATORS SHALL OBTAIN PRIOR WRITTEN RE-APPROVAL FROM THE MANUFACTURER EVERY TIME AN APPLICATION VARIES IN ANY WAY FROM THE INITIAL APPROVED USAGE. THERE IS NO DIFFERENCE BETWEEN A CHANGE OF APPLICATION AND A NEW USAGE QUALIFICATION.

- CATEGORY II DUCTLESS HOODS MUST STOP PROCEDURE IMMEDIATELY FOLLOWING FILTER SATURATION DETECTION.
Scientific Equipment & Furniture Association
Recommended Practices

SEFA 10-2013
Adaptable Laboratory Furniture Systems

SEFA World Headquarters
65 Hilton Avenue
Garden City, NY 11530
Tel: 516-294-5424
Fax: 516-294-2758
www.sefalabs.com
### Table of Contents

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Committee Members</td>
<td>312</td>
</tr>
<tr>
<td>Foreword</td>
<td>313</td>
</tr>
<tr>
<td><strong>SECTIONS</strong></td>
<td></td>
</tr>
<tr>
<td>1.0 Scope</td>
<td>314</td>
</tr>
<tr>
<td>2.0 Purpose</td>
<td>314</td>
</tr>
<tr>
<td>3.0 Definitions</td>
<td>314</td>
</tr>
<tr>
<td>3.1 Adaptable Laboratory Casework Defined</td>
<td></td>
</tr>
<tr>
<td>3.2 Characteristics of Adaptable Casework Systems</td>
<td></td>
</tr>
<tr>
<td>3.3 Vibration</td>
<td></td>
</tr>
<tr>
<td>3.4 Mobile Casework</td>
<td></td>
</tr>
<tr>
<td>3.5 Glossary of Terms</td>
<td></td>
</tr>
<tr>
<td>3.6 Codes and Standards</td>
<td></td>
</tr>
<tr>
<td>4.0 Classifying Adaptable Laboratory Furniture Systems</td>
<td>318</td>
</tr>
<tr>
<td>4.1 Description of Classes</td>
<td></td>
</tr>
<tr>
<td>5.0 Adaptable Laboratory Furniture System Class Data Sheets</td>
<td>320</td>
</tr>
<tr>
<td>5.1 Class 1</td>
<td></td>
</tr>
<tr>
<td>5.2 Class 2</td>
<td></td>
</tr>
<tr>
<td>5.3 Class 3</td>
<td></td>
</tr>
<tr>
<td>5.4 Class 4</td>
<td></td>
</tr>
<tr>
<td>5.5 Class 5</td>
<td></td>
</tr>
<tr>
<td>5.6 Class 6</td>
<td></td>
</tr>
<tr>
<td>5.7 Class 7</td>
<td></td>
</tr>
<tr>
<td>5.8 Class 8</td>
<td></td>
</tr>
<tr>
<td>6.0 Test Criteria</td>
<td>336</td>
</tr>
<tr>
<td>6.1 Purpose of Test</td>
<td></td>
</tr>
<tr>
<td>6.2 Description of Test Bench</td>
<td></td>
</tr>
<tr>
<td>6.3 Live Load</td>
<td></td>
</tr>
<tr>
<td>6.3.1 Each Shelf</td>
<td></td>
</tr>
<tr>
<td>6.3.2 Worksurface</td>
<td></td>
</tr>
<tr>
<td>6.4 Strength Test Configuration 1</td>
<td></td>
</tr>
<tr>
<td>6.4.1 Test Procedure</td>
<td></td>
</tr>
<tr>
<td>6.4.2 Acceptance Criteria</td>
<td></td>
</tr>
<tr>
<td>6.4.3 Test Procedure Continued</td>
<td></td>
</tr>
<tr>
<td>6.4.4 Acceptance Criteria</td>
<td></td>
</tr>
<tr>
<td>6.5 Stability Test Anchored Units</td>
<td></td>
</tr>
<tr>
<td>6.6 Resistance to Overturning</td>
<td></td>
</tr>
<tr>
<td>6.6.1 Test Procedure</td>
<td></td>
</tr>
<tr>
<td>6.6.2 Acceptance Criteria</td>
<td></td>
</tr>
<tr>
<td>6.7 Strength Test Configuration 2</td>
<td></td>
</tr>
<tr>
<td>6.7.1 Test Procedure</td>
<td></td>
</tr>
<tr>
<td>6.7.2 Acceptance Criteria</td>
<td></td>
</tr>
<tr>
<td>6.8 Stability Test Anchored Units</td>
<td></td>
</tr>
<tr>
<td>6.8.1 Test Procedure</td>
<td></td>
</tr>
<tr>
<td>6.8.2 Acceptance Criteria</td>
<td></td>
</tr>
<tr>
<td>6.9 Resistance to Overturning</td>
<td></td>
</tr>
<tr>
<td>6.9.1 Test Procedure</td>
<td></td>
</tr>
<tr>
<td>6.9.2 Acceptance Criteria</td>
<td></td>
</tr>
<tr>
<td>6.10 Strength Test Configuration 3</td>
<td></td>
</tr>
<tr>
<td>6.10.1 Test Procedure</td>
<td></td>
</tr>
<tr>
<td>6.10.2 Acceptance Criteria</td>
<td></td>
</tr>
<tr>
<td>6.11 Stability Test Anchored Units</td>
<td></td>
</tr>
<tr>
<td>6.11.1 Test Procedure</td>
<td></td>
</tr>
<tr>
<td>6.11.2 Acceptance Criteria</td>
<td></td>
</tr>
<tr>
<td>6.12 Resistance to Overturning</td>
<td></td>
</tr>
<tr>
<td>6.12.1 Test Procedure</td>
<td></td>
</tr>
<tr>
<td>6.12.2 Acceptance Criteria</td>
<td></td>
</tr>
<tr>
<td>6.13 Strength Test Configuration 4</td>
<td></td>
</tr>
<tr>
<td>6.13.1 Test Procedure</td>
<td></td>
</tr>
<tr>
<td>6.13.2 Acceptance Criteria</td>
<td></td>
</tr>
<tr>
<td>6.14 Stability Test Anchored Units</td>
<td></td>
</tr>
<tr>
<td>6.14.1 Test Procedure</td>
<td></td>
</tr>
<tr>
<td>6.14.2 Acceptance Criteria</td>
<td></td>
</tr>
<tr>
<td>6.15 Resistance to Overturning</td>
<td></td>
</tr>
<tr>
<td>6.15.1 Test Procedure</td>
<td></td>
</tr>
<tr>
<td>6.15.2 Acceptance Criteria</td>
<td></td>
</tr>
<tr>
<td><strong>7.0 Product Testing</strong></td>
<td>342</td>
</tr>
<tr>
<td>7.1 Forms</td>
<td></td>
</tr>
<tr>
<td><strong>Appendix</strong></td>
<td>347</td>
</tr>
<tr>
<td>A Class Adaptability Rating Chart</td>
<td></td>
</tr>
<tr>
<td>B Class Functionality Rating Chart</td>
<td></td>
</tr>
</tbody>
</table>
SEFA 10 Committee Members

Co-Chairs
Kurt Rindoks - Kewaunee Scientific Corporation
Chip Albright - Creative Solutions

AirMaster Systems  Lab Crafters
BSA Life Structures  Labguard
Bedcolab, Ltd.  Lexus Muebles
Bostontec by Case Systems  Mott Manufacturing
CHC Lab  Oriental Giken
Cabinets by Design  RFD
Chicago Faucet  Scientific Plastics
CiF Casework Solutions  SmithGroupJJR
Dalton USA  Staubli
Diversified Woodcrafts  TFI Inline Design Corporation
Flad Architects  TMI Systems Design Corporation
HEMCO Corporation  Ultra Labs, LLC.
Institutional Casework, Inc.  VWR International
Kewaunee Scientific Corporation  Vacuubrand
LM Air Technologies, Inc.  Water Saver Faucet Company
Foreword

SEFA Profile

The Scientific Equipment and Furniture Association (SEFA) is an international trade association comprised of manufacturers of laboratory furniture, casework, fume hoods and other related products, along with members of the design and installation professions. The Association was founded to promote this rapidly expanding industry and improve the quality, safety and timely completion of laboratory facilities in accordance with customer requirements.

SEFA Recommended Practices

SEFA and its committees are active in the development and promotion of Recommended Practices having domestic and international applications. Recommended Practices are developed by the association taking into account the work of other standard writing organizations. Liaison is also maintained with government agencies in the development of their specifications.

SEFA’s Recommended Practices are developed in and for the public interest. These practices are designed to promote a better understanding between designers, architects, manufacturers, purchasers, and end-users and to assist the purchaser in selecting and specifying the proper product to meet the user’s particular needs. SEFA’s Recommended Practices are periodically updated. The Recommended Practices are numbered to include an annual suffix which reflects the year that they were updated. SEFA encourages architects to specify these Recommended Practices as follows: “SEFA 10-2013”.

SEFA Glossary of Terms

SEFA has developed a Glossary of Terms (SEFA 4-2010) for the purpose of promoting a greater understanding between designers, architects, manufacturers, purchasers and end users. The terms defined by SEFA are frequently used in contracts and other documents, which attempt to define the products to be furnished or the work involved. The Association has approved this Glossary in an effort to provide uniformity among those who use these terms. Where a specific Recommended Practice contains definitions which differ from those in the Glossary of Terms, then the definitions in the specific Recommended Practice should be used.

SEFA encourages all interested parties to submit additional terms or to suggest any changes to those terms already defined by the Association. The definitions should be used to help resolve any disputes that may arise or to incorporate the applicable terms in any contract or related documents.

SEFA Disclaimer

SEFA uses its best effort to promulgate Recommended Practices for the benefit of the public in light of available information and accepted industry practices. SEFA does not guarantee, certify or assure the safety or performance of any products, components, or systems tested, installed, or operated in accordance with SEFA Recommended Practices or that any tests conducted under its Recommended Practices will be non-hazardous or free from risk. SEFA encourages the use of third-party independent testing where appropriate.

Note: Testing as described in this document must be performed and documented by a SEFA-approved third party testing facility. See Page 34 of the SEFA Desk Reference 5th Edition Version 2.0, or visit us at SEFALABS.COM for the most current list of SEFA-approved test labs.
1.0 Scope

SEFA 10 is intended to provide designers, architects, purchasers, end users, and manufacturers workable tools for evaluating various types of adaptable laboratory furniture systems. This Recommended Practice provides descriptions of various adaptable laboratory furniture systems and evaluates important features of each system. Adaptability, strength, and functionality are rated for each adaptable system described, along with how each system integrates with laboratory services and utilities.

This document is inclusive of glossary/definitions, illustrations, descriptions, classifications and testing protocols. There is no material bias in this document.

2.0 Purpose

The purpose of this document is to describe the distinguishing characteristics of adaptable laboratory furniture systems. Each class designation identifies the key attributes for purposes of evaluating the suitability for the intended use. These classes apply to products specifically designed and manufactured for installation and use in a laboratory. All materials shall be laboratory grade and of appropriate quality and type for the purpose intended. Construction shall conform to the best practices of the scientific/laboratory furniture industry. Product finish shall be resistant to chemical spills and splashes common to a typical laboratory operation. Structural strength shall be adequate to support heavy laboratory apparatus, storage containers and heavy instruments. Products should interface with the appropriate lab services (plumbing, electrical, communication).

This document provides a common language to describe the various classes of furniture along with an overview of the generic attributes as a way to evaluate and specify a product class that is appropriate for the intended use and specific needs of an application.

3.0 Definitions

3.1 Adaptable Laboratory Furniture Systems Defined

Adaptable Laboratory Furniture systems are defined as modular furniture assemblies consisting of individual components including support structures, cabinets and storage units, worksurfaces, shelving, and accessories. This Recommended Practice includes classifications for different types of these systems based on a rating scale beginning with the least adaptable laboratory furniture system to the most adaptable system.

3.2 Characteristics of Adaptable Laboratory Furniture Systems

Adaptable Laboratory Furniture Systems are designed from modular components to create laboratory furniture assemblies that accommodate reconfiguration and/or relocation. These systems consist of pre-engineered components that are reusable. Adaptable Laboratory Furniture systems typically allow for some degree of component adjustability that may include shelving, cabinetry, worksurfaces, and utilities. Some systems require attachment to the building structure, and some are freestanding or mobile.

3.3 Vibration

Floor mounted and adaptable laboratory furniture systems have differing attributes regarding vibration isolation based on several factors. These include the vibration stability of the building structure, how the furniture is attached to the structure, how the system transfers vibration from one component to another, and how independent units are able to isolate vibration. The laboratory designer needs to take all factors into account to properly address the vibration isolation needs of the equipment being used in the laboratory. Manufacturers of different systems can recommend approaches to vibration isolation based on the individual requirements of the lab.
3.4 Mobile Cabinet

A mobile cabinet is generally defined as a free standing base cabinet storage device mounted on casters or glides. This style of casework is designed to be easily relocated by the lab user. Several factors need to be considered when specifying mobile casework. These include the load capacity, the stability of the units in both the unloaded and loaded condition, and how the units integrate with the laboratory furniture system. Common options designed to improve stability include lockable casters, counter weighting, anti-tip devices, and the use of interlocking drawer restriction hardware on multiple drawer units. Maximum 3/4 extension drawer slide is recommended for the top drawer. The laboratory designer needs to take all factors into account to properly design the mobile units for the specific application. Manufacturers of mobile cabinets can recommend approaches based on the individual requirements of the lab.

3.5 Glossary of Terms

Access Panel: Removable panel for access to utility chase.

Adaptable Casework: Modular base and wall cabinets, display fixtures and storage shelves. The generic term for both “boxes” and special desks, benching systems instrumentation and equipment support tables and transporters.

Adaptable Laboratory Furniture: A generic term for modular base and wall cabinets, display fixtures, storage shelves, benching systems, instrumentation and equipment support tables and transporters, and other structural components that create bench assemblies that allow for reconfiguration and/or adjustability.

Adaptable Systems: A group of interacting structural supports, casework and utility services that are independent elements forming or regarded as forming a collective entity.

Adjustable: The ability to adjust casework components such as cabinets, shelving, worksurfaces, table frames, legs or accessories in the vertical and/or horizontal direction.

C-Frame: A supporting floor-based leg assembly designed in a c-shape to support a surface. Upper and lower horizontal tubes are designed to support suspended base and wall cabinets. Optional slotted vertical supports are designed to support shelving.

Cabinets (Base): A base cabinet is a storage device consisting of two ends, a back, and a face. The face may be open, to access the storage area, or may be outfitted with one or more drawers and/or door(s). A base cabinet is always mounted and/or set on the floor and supports a surface.

Cabinets (Mobile): A base cabinet storage device consisting of four casters with different configurations of door and drawers. A mobile cabinet can consist of an interlocking drawer device, gang locking mechanism, anti-tip devices and counter weight for safety applications.

Cabinets (Suspended): A base cabinet storage device consisting of different configurations of doors and drawers. The base cabinet is suspended from a table frame or rail system by means of a mechanical device. The base cabinet is designed to be repositioned or removed.

Cabinets (Tall): A tall cabinet is a storage device that consists of two ends, a back and a face. The face may be open to access the storage area or may be outfitted with one or more drawers and/or door(s). A tall cabinet is always mounted on the floor and is nominally 84”.

Cabinets (Wall): A wall cabinet is a storage device consisting of two ends, a back, and a face. The face may be open to access the storage area or may be outfitted with one or more drawers and/or door(s). A wall case is typically mounted to a wall or attached to a support structure.

Cantilevered: A bracket or frame supporting a surface tied to a support structure.

Carts: See instrument carts

Core: The structural element of a Class 4 core based casework system. The core typically supports casework elements such as table frames,
worksurfaces, suspended cabinetry, shelving and accessories. It is typically fixed in place and is designed to house plumbing, electrical, and data piping and wiring. Also see “Module”.

**Chase (Plumbing Area):** Space located behind the back of the base cabinet used to house plumbing, electrical lines, or data lines.

**Corner Post:** Two-way or three-way structural connectors designed to accommodate 90 degree intersections of cores, frames, or panels.

**Deflection:** The movement of a structure or structural part as a result of stress or weight loads.

**Docking Station:** A support structure designed for centralized distribution of utilities. Designed to be used in conjunction with table, carts and transporters.

**Drain Line:** The pipe or tubing used to connect the sink tail piece or trap to the building waste line.

**Equipment Rack:** A movable or mobile racking system that accommodates laboratory equipment or instrumentation. Shelving enables vertical stacking of equipment.

**Face Inserts:** A removable panel or insert which can be removed for access to a utility chase or service area.

**Filler Panel:** A panel used to close an open space between a unit and a wall or between two units.

**Floor Mounted:** Traditional casework construction where the cabinet is supported and attached to the floors and walls of the building.

**Freestanding:** Requiring no support or fastening to other structures.

**Interchangeable:** Casework system components that can be utilized in like sized system elements.

**Instrument Cart:** A mobile structure designed to support and transport instrumentation and laboratory equipment. Components can be independent and reconfigurable.

**Island Core:** A vertical support utility chase designed to support cantilevered worksurfaces, storage units and service outlets and fittings. Island units are free-standing and not tied to the building structure other than the floor.

**Manifold:** A fitting or pipe with many outlets or connections relatively close together.

**Mobile Casework:** see Cabinets (Mobile)

**Module:** see Core — The structural element of a Class 4 core based casework system. The core typically supports casework elements such as table frames, worksurfaces, suspended cabinetry, shelving and accessories. It is typically fixed in place and is designed to house plumbing, electrical, and data piping and wiring.

**Modular:** Casework and casework system designs that use a standard set of dimensions for the key elements of the system.

**Movable Casework:** see Cabinets (Mobile)

**Overhead Service Carrier (Horizontal and Vertical):** Overhead service carriers are designed to deliver ceiling fed utilities in pre-determined, repeatable, patterns incorporating valves, connections, outlets, and other distribution systems.

**P-Frame:** A system consisting of an enclosed utility chase supported by p-shaped support legs. The p-shaped support legs are either fixed in height or height adjustable through a telescoping inner leg member. The modular utility chase houses service lines and provides support for table frames and storage components.

**Panel Assembly:** Panel assemblies provide support structures where no plumbed services are required. Structural support extends both above and below the work surface height.

**Panel-supported:** Individually connected panels and work surface, filing, storage, and shelving components and accessories that receive their primary support from the panels and that, when combined, form complete workstations.

**Peninsula Core:** A vertical support utility chase designed to support cantilevered worksurfaces,
storage units and service outlets and fittings. Peninsula units are free-standing and can be tied to the building structure. Peninsula units run perpendicular to the perimeter casework and utility chase of the lab module.

**Pipe Support:** A rack of framework located in the service tunnel to support the service lines.

**Power Pole:** Power poles are used between corner posts, panel connections, tables and the ceiling to conceal and route electrical, data, and communication wiring.

**Quick Connect:** Devices used in place of the serrated tip where quick connect requirements are needed for water, air, and non-corrosive gases. Typically associated with utility docking stations and overhead service carriers.

**Reagent Cap/Ledge:** A surface that is provided down the middle of center tables, island or peninsulas to provide a means to support mechanical and electrical services and service fittings as needed.

**Relocatable:** A casework system or component that can be moved without modification.

**Seismic Kit:** A brace kit designed to be tied to a structural support and the building structure to meet seismic requirements occurring in earthquake zones.

**Service:** The supplying of utilities or commodities such as water, air, gas, vacuum, and steam as required in hospital or laboratory functions. This can also refer to power or data.

**Service Bridge:** An elevated horizontal utility bridge that provides access to service fixtures and an obstruction free work area. Service bridge houses electrical, data, media, lighting and chase for localized exhaust.

**Service Delivery Modules:** Any number of utility delivery modules that house electrical, plumbing, communication service fitting i.e. overhead service carriers, service pedestal, docking stations, etc.

**Service Line:** Pipe or tubing used to convey the service, gas or liquid, from the building service line to the service fitting on the laboratory furniture or equipment.

**Service Pedestal:** Service pedestals include electrical outlet boxes, service fittings, and other utility outlets that are mounted to a surface or reagent ledge.

**Service Tunnel or Service Chase:** Area in back of or between the backs of base cabinets and under the working surface provided to allow room for several lines.

**Service Turret:** An enclosure that projects above the table top to provide room for the service line to be brought up through the table top or be connected to the service fittings that are mounted on the outside surface of the enclosure.

**Service Umbilical:** A fully enclosed chase containing service lines extending from the ceiling area above the laboratory bench into the service tunnel of the same laboratory bench.

**Shelving:** A flat surface fastened horizontally to a cabinet interior or a wall used to hold objects.

**Shelving (Cantilevered):** A flat surface fastened to a vertical support that is slotted to accept brackets that enable the shelf to be repositioned vertically.

**Strength:** Known also as “modulus of rupture” or “flexural strength” and is the ultimate or breaking strength. Generally measured by supporting a strip of material across two supports and applying a load between these supports. By computation the strength values can be used to determine the load-carrying ability of the product and may be used to compare strengths of different products.

**Support Structures:** Vertical and horizontal structural supports that support storage components, utility delivery systems and work surfaces.

**Suspended:** Typically referring to casework and laboratory furniture accessories suspended from a frame and/or rail system.

**Tables:** An article of furniture having a flat, horizontal surface supported by one or more support members (legs), and a frame (apron).

**Tables (Movable):** An article of furniture having a flat, horizontal surface supported by one or more
support members (legs), and a frame (apron). Leg members are equipped with a leveling and/or support device that does not require the table to be permanently fixed to the building structure.

**Tables (Mobile):** An article of furniture having a flat, horizontal surface supported by one or more support members (legs), and a frame (apron). Leg members are equipped with a caster device that enables the support structure to be freely transported throughout the building structure.

**Table Frame:** Support structure supporting a worksurface. A table frame can be a free-standing unit or cantilevered from a vertical support. Table frames may also support casework and accessory components.

**Transporters:** Any number of cart or table delivery modules that transport and store laboratory equipment and instrumentation, i.e. instrument carts, mobile tables, and mobile cabinets, etc.

**Utilities:** Plumbing, electrical, and/or data devices and their associated piping, wiring, conduit, etc.

### 3.6 Codes and Standards (Related to)

- **SEFA 3** – Recommended Practices for Work Tops
- **SEFA 4** – Glossary of Terms
- **SEFA 8** – Recommended Practices for Casework
- **UL 61010A-1** – Electrical Equipment for Laboratory Use
- **UL 962** – Household and Commercial Furnishings

### 4.0 Classifying Adaptable Furniture Systems

The adaptable systems described in this Recommended Practice have been classified based on a rating scale beginning with the least adaptable laboratory furniture system to the most adaptable system. An adaptability chart (see Appendix A) was created to define the common tasks associated with laboratory furniture adaptability, and assigns each system a numerical scoring range based on how that particular task can be accommodated by the particular adaptable system. The total point range for a particular system determines its position in the classification, from lowest (least adaptable) to highest.

#### 4.1 Description of Classes

**Class 1 – FIXED FLOOR MOUNTED AND WALL SUPPORTED**

Floor mounted casework utilizes traditional base cabinet construction which is supported and attached to the floors and walls of the building. The cabinetry can be either built-in or modular. Worksurfaces are mounted to the top of the base cabinets in continuous lengths.

**Class 2 – WALL RAIL SUPPORTED**

Wall rail casework systems use a wall mounted fixed horizontal and/or vertical support rail from which the cabinetry is hung. The rail can be positioned to support under counter base units, above counter wall cases, shelving, or other ancillary items. The worksurface is typically mounted to the under counter base units, although independently supported worksurfaces can be utilized. Some systems allow for hanging the casework and worksurface at varying heights.

**Class 3 – SELF SUPPORTING FRAME**

Self Supporting Frame casework systems utilize a floor supported cantilevered support frame (C-Frame). Some systems are fully cantilevered; some utilize a front leg for added strength and stability. The frame can be worksurface height or also include above counter framing. Base cabinets, upper cabinets, worksurfaces, shelving, service utility distribution, and ancillary items can be suspended from the frame structure. Typically, the frame utilizes a support leg structure connected by horizontally run support members. The frame can be constructed to provide a chase for horizontally run services beneath the worksurface and behind the base cabinets. Typically, the worksurfaces are supported independently of the cabinets, allowing for cabinet relocation horizontally within the structure. Some systems are designed with height adjustable support legs. Self supporting frame systems can also be used in conjunction with mobile or floor mounted casework.
**Class 4 – CORE BASED**

Core based casework systems utilize a floor mounted support module (core) from which table frames, upper cabinets, shelving, service utility distribution, and ancillary items are suspended. The core module is typically anchored to the floor and/or adjacent walls or structural members, to provide a self-supporting structure for all system components. Core modules can be worksurface height or also include an above counter structure. The core modules provide a chase for horizontally and vertically run services. The core modules can be provided with enclosure panels or be open. Base cabinets can be floor mounted or mobile in front of the support module, or suspended from table frames supported by the core module. Typically, individual core modules are provided in varying lengths and are combined to create full length assemblies. Table frames with worksurfaces and shelving are suspended from the core modules. Typically the Core module incorporates adjustment slots for vertical height adjustability of worksurfaces, shelving and ancillary items.

**Class 5 – PANEL BASED**

Panel based systems are similar to Core based systems except they utilize a narrow support module, typically 6” or less. This narrow panel design limits the available space for service utility distribution. These panel assemblies are sometimes used as wall partitions, and can include features such as glass inserts, doors, and other features associated with internal wall partitions. These systems can require attachment to overhead structures in addition to floor and/or wall anchoring.

**Class 6 – TABLE BASED**

Table based systems use independent floor mounted self-supporting tables as the key component. They are used in conjunction with separate wall mounted or structural upper storage systems. The tables can be adjustable in height, and can be designed to support suspended base cabinets, and/or floor mounted or mobile base units. For this class, these tables do not have above worksurface structures integrated into the table. Utilities, sinks, and other fixed elements are typically separate from the tables, allowing the tables to be easily relocated.

**Class 7 – FREE STANDING WORKSTATION**

Free Standing Workstations are table based systems utilizing floor mounted tables as the key component. The workstation can be worksurface height or incorporate above counter structure. The workstations can incorporate either adjustable height or fixed height worksurfaces. Base cabinets can be mobile, floor mounted, or suspended. Upper cabinets, worksurfaces, shelving, service utility distribution, and ancillary items can be suspended from the frame structure. Free Standing Workstations with above counter structures can be preplumbed and prewired, and used in conjunction with ceiling mounted service utility distribution systems. Typically, Free Standing Workstations incorporate adjustment slots for vertical height adjustability of worksurfaces, shelving and ancillary items. Free Standing Workstations are not anchored to the building, allowing for simple relocation.

**Class 8 – MOBILE WORKSTATION**

Mobile Workstations are similar to Free Standing Workstations, but are typically mounted on casters to accommodate simple relocation. The workstation can be worksurface height or incorporate above counter structure. The workstation can incorporate either adjustable height or fixed height worksurfaces. Base cabinets can be mobile, floor mounted, or suspended. Upper cabinets, worksurfaces, shelving, service utility distribution, and ancillary items can be suspended from the frame structure. Mobile Workstations with above counter structures can be preplumbed and prewired, and used in conjunction with ceiling mounted service utility distribution systems. Typically, Mobile Workstations incorporate adjustment slots for vertical height adjustability of worksurfaces, shelving and ancillary items.
### Class 1 – FIXED CASEWORK

Fixed or floor mounted casework utilizes traditional base cabinet construction supported and attached to the floors and walls of the building. The cabinetry can be either modular or custom built. Worksurfaces are mounted to the top of the base cabinets in continuous lengths.

### Adaptability Features:

- Cabinets and worksurfaces are not adjustable or easily reconfigurable. If the cabinetry is modular, casework can be uninstalled then reinstalled in a new configuration or location. New components may be required for relocation.
- Wall cases or shelving and can be fixed or adjustable depending on design.
- Utilities are typically mounted directly to the worksurfaces or casework. Horizontal pipe chase areas are created by offsetting the cabinets from the wall and running utilities within the space.
5.1 CLASS 1 – FIXED – FLOOR MOUNTED & WALL SUPPORTED CASEWORK

Functionality Features:

- Fixed casework can be designed to provide a high degree of cleanability. Cabinets can be caulked or sealed to the wall, base molding can be sealed to the floor, and other cracks and crevices can be sealed or minimized. Continuous worksurfaces and sealable joints are excellent for wet lab applications.
- Fixed casework provides the highest storage volume rating, with little unusable space.
- Strength, stability and vibration control rate high when fixed casework is properly anchored to the building structure.
- In lieu of a test bench, see SEFA 8 for laboratory grade performance criteria.

Class 1 – ADAPTABILITY RATING CHART *

<table>
<thead>
<tr>
<th>Action</th>
<th>Class 1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Relocate a Cabinet</td>
<td>1 – 2</td>
</tr>
<tr>
<td>Relocate a Bench</td>
<td>1 – 2</td>
</tr>
<tr>
<td>Adjust a Worksurface</td>
<td>0 – 0</td>
</tr>
<tr>
<td>Add a Shelf</td>
<td>2 – 4</td>
</tr>
<tr>
<td>Adjust a Shelf</td>
<td>2 – 4</td>
</tr>
<tr>
<td>Relocate a Utility</td>
<td>1 – 1</td>
</tr>
</tbody>
</table>

Adaptability Range 7 – 13

* See Appendix A

Class 1 – FUNCTIONALITY RATING CHART **

<table>
<thead>
<tr>
<th>Action</th>
<th>Class 1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cleanability</td>
<td>3 – 4</td>
</tr>
<tr>
<td>Storage Volume</td>
<td>4 – 4</td>
</tr>
<tr>
<td>Strength – Overall</td>
<td>4 – 4</td>
</tr>
<tr>
<td>Strength – Worksurface</td>
<td>1 – 4</td>
</tr>
<tr>
<td>Stability – Tipping</td>
<td>0 – 1</td>
</tr>
</tbody>
</table>

Functionality Range 12 – 17

** See Appendix B
5.2 CLASS 2 – WALL RAIL SUPPORTED

Class 2 – WALL RAIL SUPPORTED

Wall rail casework systems use a wall mounted fixed horizontal and/or vertical support rail from which the cabinetry is hung. The rail can be positioned to support under counter base units, above counter wall cases, shelving, or other ancillary items. The worksurface is typically mounted to the under counter base units, although independently supported worksurfaces can be utilized. Some systems allow for hanging the casework and worksurface at varying heights.

Adaptability Features:

- Wall rail supported systems typically allow for some degree of base cabinet relocation along the length of the rail system. The structural requirements of the worksurface may limit this feature, as the worksurface commonly uses the base cabinets for support.
- Bench relocation is possible by dismantling the rail system from the wall and reassembling in another area. New components are not necessarily required.
- Worksurface height adjustments can be accomplished within a limited range with some designs.
- Wall cases or shelving can be fixed or adjustable depending on design.
- Utilities are typically mounted directly to the worksurfaces or casework. Wall rail supported systems may require horizontal utility runs to be placed within the wall.
5.2 CLASS 2 – WALL RAIL SUPPORTED

Functionality Features:

- Wall rail supported systems, like many adaptable systems that utilize suspended casework, create areas behind and between cabinet and structural elements that can be difficult to access and clean. Worksurfaces can be sealed in continuous lengths, but this can limit casework adjustability.
- Storage volume is good, but restricted to base cabinet size restrictions common to all suspended casework systems.
- Strength, stability and vibration isolation are related to the design and components of the individual system and the anchorage to the wall.

Class 2 – ADAPTABILITY RATING CHART *

<table>
<thead>
<tr>
<th>Action</th>
<th>Class 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Relocate a Cabinet</td>
<td>3 – 3</td>
</tr>
<tr>
<td>Relocate a Bench</td>
<td>1 – 3</td>
</tr>
<tr>
<td>Adjust a Worksurface</td>
<td>3 – 4</td>
</tr>
<tr>
<td>Add a Shelf</td>
<td>2 – 4</td>
</tr>
<tr>
<td>Adjust a Shelf</td>
<td>3 – 4</td>
</tr>
<tr>
<td>Relocate a Utility</td>
<td>1 – 1</td>
</tr>
</tbody>
</table>

Adaptability Range 13 – 19

Class 2 – FUNCTIONALITY RATING CHART **

<table>
<thead>
<tr>
<th>Action</th>
<th>Class 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cleanability</td>
<td>1 – 3</td>
</tr>
<tr>
<td>Storage Volume</td>
<td>1 – 3</td>
</tr>
<tr>
<td>Strength – Overall</td>
<td>2 – 3</td>
</tr>
<tr>
<td>Strength – Worksurface</td>
<td>1 – 4</td>
</tr>
<tr>
<td>Stability – Tipping</td>
<td>0 – 1</td>
</tr>
</tbody>
</table>

Functionality Range 5 – 14

* See Appendix A
** See Appendix B
5.3 CLASS 3 – SELF-SUPPORTING FRAME

Class 3 – SELF-SUPPORTING FRAME

Self Supporting Frame casework systems utilize a floor supported cantilevered support frame (C-Frame). Some systems are fully cantilevered; some utilize a front leg for added strength and stability. The frame can be worksurface height or also include above counter framing. Base cabinets, upper cabinets, worksurfaces, shelving, service utility distribution, and ancillary items can be suspended from the frame structure. Typically, the frame utilizes a support leg structure connected by horizontally run support members. The frame can be constructed to provide a chase for horizontally run services beneath the worksurface and behind the base cabinets. Typically, the worksurfaces are supported independently of the cabinets, allowing for cabinet relocation horizontally within the structure. Some systems are designed with height adjustable support legs. Self supporting frame systems can also be used in conjunction with mobile or floor mounted casework.

Adaptability Features:

- Self supporting frame systems typically allow for fairly simple cabinet relocation along the horizontal frame.
- Bench relocation is only possible by dismantling or disconnecting the frame system from the wall and/or floor and reassembling in another area. New components are not necessarily required.
- Worksurface height adjustment is not possible with most self supporting frame designs. The systems that offer worksurface height adjustment typically use a telescoping frame design for the vertical members. Height adjustment requires removal of the suspended casework and worksurfaces, adjusting the vertical members, then reattaching the suspended units and worksurfaces.
- Wall cases or shelving can be wall mounted, or mounted to above worksurface framework that is part of the self supporting frame structure. Shelf adjustability depends on the system design.
- Utilities are typically mounted directly to the worksurface, with horizontal utility lines attached to the system framework.
5.3 CLASS 3 – SELF-SUPPORTING FRAME

Functionality Features:

- Self-supporting frame systems, like many adaptable systems that utilize suspended casework, create areas behind and between cabinet and structural elements that can be difficult to access and clean. Worksurfaces can be sealed in continuous lengths, but this can limit casework adjustability.
- Storage volume is good, but restricted to base cabinet size restrictions common to all suspended casework systems.
- Strength, stability and vibration isolation are related to the design and components of the individual system and anchorage to the wall.

Class 3 – ADAPTABILITY RATING CHART *

<table>
<thead>
<tr>
<th>Action</th>
<th>Class 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Relocate a Cabinet</td>
<td>2 – 4</td>
</tr>
<tr>
<td>Relocate a Bench</td>
<td>2 – 3</td>
</tr>
<tr>
<td>Adjust a Worksurface</td>
<td>2 – 3</td>
</tr>
<tr>
<td>Add a Shelf</td>
<td>4 – 4</td>
</tr>
<tr>
<td>Adjust a Shelf</td>
<td>4 – 4</td>
</tr>
<tr>
<td>Relocate a Utility</td>
<td>1 – 1</td>
</tr>
</tbody>
</table>

Adaptability Range  15 – 19

Class 3 – FUNCTIONALITY RATING CHART **

<table>
<thead>
<tr>
<th>Action</th>
<th>Class 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cleanability</td>
<td>1 – 3</td>
</tr>
<tr>
<td>Storage Volume</td>
<td>1 – 3</td>
</tr>
<tr>
<td>Strength – Overall</td>
<td>2 – 4</td>
</tr>
<tr>
<td>Strength – Worksurface</td>
<td>1 – 4</td>
</tr>
<tr>
<td>Stability – Tipping</td>
<td>0 – 1</td>
</tr>
</tbody>
</table>

Functionality Range 5 – 15

* See Appendix A  
** See Appendix B
5.4 CLASS 4 – CORE BASED

Core based casework systems utilize a floor mounted support module (core) from which table frames, upper cabinets, shelving, service utility distribution, and ancillary items are suspended. The core module is typically anchored to the floor and/or adjacent walls or structural members, to provide a self-supporting structure for all system components. Core modules can be worksurface height or also include an above counter structure. The core modules provide a chase for horizontally and vertically run services. The core modules can be provided with enclosure panels or be open. Base cabinets can be floor mounted or mobile in front of the support module, or suspended from table frames supported by the core module. Typically, individual core modules are provided in varying lengths and are combined to create full length assemblies. Table frames with work surfaces, and shelving are suspended from the core modules. Typically the Core module incorporates adjustment slots for vertical height adjustability of worksurfaces, shelving and ancillary items.

Adaptability Features:

- Core based casework systems typically provide for simple cabinet relocation when suspended or mobile cabinetry is used.
- Bench relocation is only possible by dismantling and disconnecting the core system from the wall and/or floor and reassembling in another area. New components are not necessarily required.
- Worksurface height adjustment is accomplished on most of these systems by individual support frames hung from the cores with a height adjustable slot design. Suspended cabinets are first removed, and then the worksurface and its frame are lifted (often with a mechanical lift device) and placed in a new position on the core.
- Wall cases or shelving can be wall mounted, or mounted to above worksurface framework that is part of the core structure. Shelf adjustability depends on the system, but is typically a simple slot design.
- Utilities are typically mounted directly to the cores, with horizontal utility lines attached within the core system framework.
5.4 CLASS 4 – CORE BASED

Class 1  Class 2  Class 3  Class 4  Class 5  Class 6  Class 7  Class 8

<table>
<thead>
<tr>
<th>Least Adaptive</th>
<th>Most Adaptive</th>
</tr>
</thead>
<tbody>
<tr>
<td>Floor Mounted</td>
<td>Panel Based</td>
</tr>
<tr>
<td>Wall Rail</td>
<td>Table Based</td>
</tr>
<tr>
<td>Self-Supporting Frame</td>
<td>Free-Standing Workstation</td>
</tr>
<tr>
<td>Core Based</td>
<td>Mobile Workstation</td>
</tr>
</tbody>
</table>

Functionality Features:

- Core based systems, like many adaptable systems that utilize suspended casework, create areas behind and between cabinets and structural elements that can be difficult to access and clean. Worksurfaces are typically not sealed in continuous lengths, as this interferes with worksurface height adjustment. Soft caulk is sometimes used for joints when a liquid seal is important.
- Storage volume is good, but restricted to base cabinet size restrictions common to all suspended casework systems.
- Strength, stability and vibration isolation are related to the design and components of the individual system, and the anchorage to the wall and/or floor.

Class 4 – ADAPTABILITY RATING CHART *

<table>
<thead>
<tr>
<th>Action</th>
<th>Class 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Relocate a Cabinet</td>
<td>2 – 4</td>
</tr>
<tr>
<td>Relocate a Bench</td>
<td>2 – 3</td>
</tr>
<tr>
<td>Adjust a Worksurface</td>
<td>2 – 4</td>
</tr>
<tr>
<td>Add a Shelf</td>
<td>4 – 4</td>
</tr>
<tr>
<td>Adjust a Shelf</td>
<td>4 – 4</td>
</tr>
<tr>
<td>Relocate a Utility</td>
<td>1 – 1</td>
</tr>
</tbody>
</table>

Adaptability Range 15 – 20

Class 4 – FUNCTIONALITY RATING CHART **

<table>
<thead>
<tr>
<th>Action</th>
<th>Class 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cleanability</td>
<td>1 – 3</td>
</tr>
<tr>
<td>Storage Volume</td>
<td>1 – 3</td>
</tr>
<tr>
<td>Strength – Overall</td>
<td>3 – 4</td>
</tr>
<tr>
<td>Strength – Worksurface</td>
<td>1 – 4</td>
</tr>
<tr>
<td>Stability – Tipping</td>
<td>0 – 1</td>
</tr>
</tbody>
</table>

Functionality Range 6 – 15

* See Appendix A
** See Appendix B
### Class 5 – Panel Based

Panel based systems are similar to Core based systems (see Class 4) except they utilize a narrow support module, typically 6” or less. This narrow panel design limits the available space for service utility distribution. These panel assemblies are sometimes used as wall partitions, and can include features such as glass inserts, doors, and other features associated with internal wall partitions. These systems can require attachment to overhead structures in addition to floor and/or wall anchoring.

#### Adaptability Features:

- Panel based casework systems typically provide for simple cabinet relocation when suspended or mobile cabinetry is used.
- Bench relocation is only possible by dismantling and disconnecting the panel system from the wall, floor and/or ceiling, then reassembling in another area. New components are not necessarily required.
- Worksurface height adjustment is accomplished on most of these systems by individual support frames hung from the panel with a height adjustable slot design. Suspended cabinets are first removed, and then the worksurface and its frame are lifted (often with a mechanical lift device) and placed in a new position on the panel.
- Wall cases or shelving can be wall mounted, or mounted to above worksurface framework that is part of the panel structure. Shelf adjustability depends on the system, but is typically a simple slot design.
- Utilities are typically mounted directly to the panels, with horizontal utility lines attached within the panel system framework.
5.5 CLASS 5 – PANEL BASED

Functionality Features:

- Panel based systems, like many adaptable systems that utilize suspended casework, create areas behind and between cabinets and structural elements that can be difficult to access and clean. Worksurfaces are typically not sealed in continuous lengths, as this interferes with worksurface height adjustment. Soft caulk is sometimes used for joints when a liquid seal is important.

- Storage volume is good, but restricted to base cabinet size restrictions common to all suspended or mobile casework systems.

- Strength, stability and vibration isolation are related to the design and components of the individual system, and the anchorage to the wall and/or floor.

Class 5 – ADAPTABILITY RATING CHART *

<table>
<thead>
<tr>
<th>Action</th>
<th>Class 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Relocate a Cabinet</td>
<td>2 – 4</td>
</tr>
<tr>
<td>Relocate a Bench</td>
<td>2 – 3</td>
</tr>
<tr>
<td>Adjust a Worksurface</td>
<td>3 – 4</td>
</tr>
<tr>
<td>Add a Shelf</td>
<td>4 – 4</td>
</tr>
<tr>
<td>Adjust a Shelf</td>
<td>4 – 4</td>
</tr>
<tr>
<td>Relocate a Utility</td>
<td>1 – 1</td>
</tr>
</tbody>
</table>

Adaptability Range 16 – 20

Class 5 – FUNCTIONALITY RATING CHART **

<table>
<thead>
<tr>
<th>Action</th>
<th>Class 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cleanability</td>
<td>1 – 3</td>
</tr>
<tr>
<td>Storage Volume</td>
<td>1 – 3</td>
</tr>
<tr>
<td>Strength – Overall</td>
<td>2 – 4</td>
</tr>
<tr>
<td>Strength – Worksurface</td>
<td>1 – 4</td>
</tr>
<tr>
<td>Stability – Tipping</td>
<td>0 – 1</td>
</tr>
</tbody>
</table>

Functionality Range 5 – 15

* See Appendix A
** See Appendix B
Class 6 – TABLE BASED

Table based systems use independent floor mounted self-supporting tables as the key component. They are used in conjunction with separate wall mounted or structural upper storage systems. The tables can be either adjustable or fixed height. The base cabinets can be mobile, floor mounted, or suspended from the tables. For this class, these tables do not have above worksurface structures integrated into the table. Utilities, sinks, and other fixed elements are typically separate from the tables, allowing the tables to be easily relocated.

Adaptability Features:

- Table based systems typically use mobile or suspended base cabinetry allowing for simple relocation of base units. It is more common for these systems to use mobile casework units that are on casters or freestanding.
- Bench relocation is a matter of moving the table to a new location. Suspended cabinets may need to be removed prior to moving.
- Worksurface height adjustment is typically accomplished on these systems by adjusting the table legs. This adjustment can be a telescoping leg design that requires a hardware mechanism for adjustment. Also crank, or power adjustment is available on some systems. Suspended casework units may need to be removed before adjustment.
- Wall cases or shelving can be wall mounted, or mounted to an independent structure. In this classification the table does not include above worksurface support structures.
- Utilities are typically mounted to specialty units such as sink units, utility drops or utility pods that are at locations convenient to the tables.
### 5.6 CLASS 6 – TABLE BASED

<table>
<thead>
<tr>
<th>Class 1</th>
<th>Class 2</th>
<th>Class 3</th>
<th>Class 4</th>
<th>Class 5</th>
<th><strong>Class 6</strong></th>
<th>Class 7</th>
<th>Class 8</th>
</tr>
</thead>
<tbody>
<tr>
<td>Least Adaptive</td>
<td>Wall Rail</td>
<td>Self-Supporting Frame</td>
<td>Core Based</td>
<td>Panel Based</td>
<td>Table Based</td>
<td>Free-Standing Workstation</td>
<td>Mobile Workstation</td>
</tr>
</tbody>
</table>

#### Functionality Features:

- Many adaptable systems that utilize suspended casework, create areas behind and between cabinets and structural elements that can be difficult to access and clean. Table based systems are designed to allow easy relocation of the entire table, allowing greater access to these areas. Worksurfaces are typically not sealed in continuous lengths; they are matched to the individual table.
- Storage volume is restricted to base cabinet size restrictions common to all suspended or mobile casework systems.
- Strength, stability and vibration isolation are related to the design and components of the individual system, and the anchorage to the wall and/or floor.

#### Class 6 – ADAPTABILITY RATING CHART *

<table>
<thead>
<tr>
<th>Action</th>
<th>Class 6</th>
</tr>
</thead>
<tbody>
<tr>
<td>Relocate a Cabinet</td>
<td>2 – 4</td>
</tr>
<tr>
<td>Relocate a Bench</td>
<td>4 – 4</td>
</tr>
<tr>
<td>Adjust a Worksurface</td>
<td>3 – 4</td>
</tr>
<tr>
<td>Add a Shelf</td>
<td>4 – 4</td>
</tr>
<tr>
<td>Adjust a Shelf</td>
<td>4 – 4</td>
</tr>
<tr>
<td>Relocate a Utility</td>
<td>1 – 1</td>
</tr>
</tbody>
</table>

**Adaptability Range**  18 – 21

#### Class 6 – FUNCTIONALITY RATING CHART **

<table>
<thead>
<tr>
<th>Action</th>
<th>Class 6</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cleanability</td>
<td>1 – 3</td>
</tr>
<tr>
<td>Storage Volume</td>
<td>1 – 3</td>
</tr>
<tr>
<td>Strength – Overall</td>
<td>2 – 3</td>
</tr>
<tr>
<td>Strength – Worksurface</td>
<td>1 – 4</td>
</tr>
<tr>
<td>Stability – Tipping</td>
<td>0 – 1</td>
</tr>
</tbody>
</table>

**Functionality Range**  5 – 14

* See Appendix A  ** See Appendix B
Class 7 – FREE-STANDING WORKSTATION

Free-standing workstations are table based systems utilizing floor mounted tables as the key component. The workstation can be worksurface height or incorporate above counter structure. The workstations can incorporate either adjustable height or fixed height worksurfaces. Base cabinets can be mobile, floor mounted, or suspended. Upper cabinets, worksurfaces, shelving, service utility distribution, and ancillary items can be suspended from the frame structure. Free-standing workstations with above counter structures can be pre-plumbed and prewired, and used in conjunction with ceiling mounted service utility distribution systems. Typically, free-standing workstations incorporate adjustment slots for vertical height adjustability of worksurfaces, shelving and ancillary items. Free-standing workstations are not anchored to the building, allowing for simple relocation.

Adaptability Features:

- Free-standing workstation systems typically use mobile or suspended base cabinetry allowing for simple relocation of base units. It is more common for these systems to use mobile casework units that are on casters or freestanding.
- Bench relocation is a matter of moving the table to a new location. Suspended cabinets may need to be removed prior to moving.
- Worksurface height adjustment is typically accomplished on these systems by adjusting the table legs. This adjustment can be a telescoping leg design that requires a hardware mechanism for adjustment. Also crank, or power adjustment is available on some systems. Suspended casework units may need to be removed before adjustment.
- Wall cases or shelving can be wall mounted, or mounted to a framework structure integrated into the workstation. Typically, a simple slot design allows for shelf adjustment.
- Free-standing workstations can incorporate pre-plumbed and prewired utilities. Often these are provided with cords and hoses to connect to quick connect fittings located in a ceiling panel or overhead service carrier.
5.7 CLASS 7 – FREE-STANDING WORKSTATION

Functionality Features:

- Many adaptable systems that utilize suspended casework, create areas behind and between cabinets and structural elements that can be difficult to access and clean. Free-standing workstation systems are designed to allow easy relocation of the entire bench, allowing greater access to these areas. Worksurfaces are typically not sealed in continuous lengths; they are matched to the individual table.
- Storage volume is restricted to base cabinet size restrictions common to all suspended or mobile casework systems.
- Strength, stability and vibration isolation are related to the design and components of the individual system. These systems are typically not anchored to the building structure.

Class 7 – ADAPTABILITY RATING CHART *

<table>
<thead>
<tr>
<th>Action</th>
<th>Class 7</th>
</tr>
</thead>
<tbody>
<tr>
<td>Relocate a Cabinet</td>
<td>2 – 4</td>
</tr>
<tr>
<td>Relocate a Bench</td>
<td>3 – 4</td>
</tr>
<tr>
<td>Adjust a Worksurface</td>
<td>3 – 3</td>
</tr>
<tr>
<td>Add a Shelf</td>
<td>4 – 4</td>
</tr>
<tr>
<td>Adjust a Shelf</td>
<td>4 – 4</td>
</tr>
<tr>
<td>Relocate a Utility</td>
<td>3 – 4</td>
</tr>
</tbody>
</table>

Adaptability Range 19 – 23

Class 7 – FUNCTIONALITY RATING CHART **

<table>
<thead>
<tr>
<th>Action</th>
<th>Class 7</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cleanability</td>
<td>2 – 3</td>
</tr>
<tr>
<td>Storage Volume</td>
<td>1 – 3</td>
</tr>
<tr>
<td>Strength – Overall</td>
<td>2 – 3</td>
</tr>
<tr>
<td>Strength – Worksurface</td>
<td>1 – 4</td>
</tr>
<tr>
<td>Stability – Tipping</td>
<td>0 – 1</td>
</tr>
</tbody>
</table>

Functionality Range 6 – 14

* See Appendix A
** See Appendix B
# 5.8 Class 8 – Mobile Workstation

<table>
<thead>
<tr>
<th>Class 1</th>
<th>Class 2</th>
<th>Class 3</th>
<th>Class 4</th>
<th>Class 5</th>
<th>Class 6</th>
<th>Class 7</th>
<th>Class 8</th>
</tr>
</thead>
<tbody>
<tr>
<td>Floor Mounted</td>
<td>Wall Rail</td>
<td>Self-Supporting Frame</td>
<td>Core Based</td>
<td>Panel Based</td>
<td>Table Based</td>
<td>Free-Standing Workstation</td>
<td>Mobile Workstation</td>
</tr>
</tbody>
</table>

### Class 8 – Mobile Workstation

Mobile Workstations are similar to Free Standing Workstations (see Class 7), but are typically mounted on casters to accommodate simple relocation. The workstation can be worksurface height or incorporate above counter structure. The workstation can incorporate either adjustable height or fixed height worksurfaces. Base cabinets can be mobile, floor mounted, or suspended. Upper cabinets, worksurfaces, shelving, service utility distribution, and ancillary items can be suspended from the frame structure. Mobile Workstations with above counter structures can be pre-plumbed and prewired, and used in conjunction with ceiling mounted service utility distribution systems. Typically, Mobile Workstations incorporate adjustment slots for vertical height adjustability of worksurfaces, shelving and ancillary items.

### Adaptability Features:

- Mobile workstation systems typically use mobile or suspended base cabinetry allowing for simple relocation of base units. It is more common for these systems to use mobile casework units that are on casters or freestanding.
- Bench relocation is a matter of moving the table to a new location. Suspended cabinets may need to be removed prior to moving.
- Worksurface height adjustment is typically accomplished on these systems by adjusting the table legs. This adjustment can be a telescoping leg design that requires a hardware mechanism for adjustment. Also crank, or power adjustment is available on some systems. Suspended casework units may need to be removed before adjustment.
- Wall cases or shelving can be wall mounted, or mounted to a framework structure integrated into the workstation. Typically, a simple slot design allows for shelf adjustment.
- Mobile workstations can incorporate pre-plumbed and prewired utilities. Often these are provided with cords and hoses to connect to quick connect fittings located in a ceiling panel or overhead service carrier.
5.8  CLASS 8 – MOBILE WORKSTATION

Functionality Features:

- Many adaptable systems that utilize suspended casework, create areas behind and between cabinets and structural elements that can be difficult to access and clean. Mobile workstation systems are designed to allow easy relocation of the entire bench, allowing greater access to these areas. Worksurfaces are typically not sealed in continuous lengths; they are matched to the individual table.
- Storage volume is restricted to base cabinet size restrictions common to all suspended or mobile casework systems.
- Strength, stability and vibration isolation are related to the design and components of the individual system. These systems are typically not anchored to the building structure.

Class 8 – ADAPTABILITY RATING CHART *

<table>
<thead>
<tr>
<th>Action</th>
<th>Class 8</th>
</tr>
</thead>
<tbody>
<tr>
<td>Relocate a Cabinet</td>
<td>3 – 4</td>
</tr>
<tr>
<td>Relocate a Bench</td>
<td>4 – 4</td>
</tr>
<tr>
<td>Adjust a Worksurface</td>
<td>3 – 4</td>
</tr>
<tr>
<td>Add a Shelf</td>
<td>4 – 4</td>
</tr>
<tr>
<td>Adjust a Shelf</td>
<td>4 – 4</td>
</tr>
<tr>
<td>Relocate a Utility</td>
<td>3 – 4</td>
</tr>
</tbody>
</table>

Adaptability Range 21 – 24

Class 8 – FUNCTIONALITY RATING CHART **

<table>
<thead>
<tr>
<th>Action</th>
<th>Class 8</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cleanability</td>
<td>1 – 3</td>
</tr>
<tr>
<td>Storage Volume</td>
<td>1 – 3</td>
</tr>
<tr>
<td>Strength – Overall</td>
<td>2 – 4</td>
</tr>
<tr>
<td>Strength – Worksurface</td>
<td>1 – 4</td>
</tr>
<tr>
<td>Stability – Tipping</td>
<td>0 – 1</td>
</tr>
</tbody>
</table>

Functionality Range 5 – 15

* See Appendix A
** See Appendix B
6.0 Test Criteria

6.1 Purpose

Many of the components used in adaptable casework shall be tested in conformance to the appropriate section within SEFA – 8. Shelves, drawers, doors, tables, coatings and component hardware are all specified for laboratory grade performance within that standard. Performance criteria specific to Adaptable Furniture relate to strength and stability. The purpose of this standard is to identify the minimal acceptable physical strength of adaptable furniture. This is not intended to replicate or in any way distract from proper engineering analysis for seismic conditions. Refer to the International Building Code, IBC - 2000 for the proper performance testing under seismic conditions.

6.2 Description of Test Unit

Four configurations have been identified to represent the majority of laboratory grade adaptable furniture. Although designs vary from manufacturer to manufacturer, the basic configuration can be represented by one of four configurations. For test purposes, all systems shall have a worksurface and two rows of shelving mounted in the location and to the size shown on the figures below.

1. single sided, cantilevered worksurface
2. double sided, cantilevered worksurface
3. single sided, simply supported worksurface
4. double sided, simply supported worksurface
The manufacturer shall provide a test unit to the design and construction details (including weldments and material choices) that properly represents their individual product family. The product shall have a continuous or a split shelf consistent with their product family. If both continuous shelving and split shelving is offered, the split shelf shall be chosen for testing (Testing agency shall provide a photograph of the assembly and record if shelves tested were continuous or split on the test certificate).

The unit shall be installed and anchored (if appropriate) as specified by the manufacturer. All anchor details will also be recorded and reported on test certificates.

Great care must be exercised when conducting these tests. SEFA assumes no liability for damage or injury as a result of conducting these tests. Before proceeding assure that you are in compliance with national, state, and regional safety regulations. These tests shall be conducted only by properly trained personnel. All safety precautions shall be taken to insure the safety of testing personnel. These tests require very heavy loads and may result in catastrophic failure that could result in damage or injury to unprepared or untrained personnel.

6.3 Live Load

6.3.1 Each Shelf

Shelf live load shall be equal to 40 lbs per square foot not to exceed 200 pounds. (example: A 6 square foot shelf calculates to 240 pounds so a load of 200 pounds shall be applied on a continuous shelf; or 120 pounds on each split shelf) All shelving load shall be applied by using ten pound sand or shot bags as specified in SEFA-8. Shelf material shall be specified by the manufacturer, installed per manufacturer’s specification and reported by the testing agency on the test certificate.

6.3.2 Worksurface

There are four categories of laboratory grade worksurface loads to adaptable furniture. The manufacturer shall specify which category is to be tested and the testing agency shall report the category on the test certificate. All worksurface loads shall be uniformly distributed over the entire worksurface by using fifty pound solid steel bars as specified in SEFA-8. Worksurface material shall be specified by the manufacturer, installed per manufacturer’s specification and reported by the testing agency on the test certificate.

Category 1 = 200 pounds  
Category 2 = 600 pounds  
Category 3 = 1000 pounds  
Category 4 = 1200 pounds

6.4 Strength Test Configuration 1
(Single Sided, Cantilevered)

Refer to Figure 5

6.4.1 Test Procedure

Measure the worksurface to find the center point (approximately at 36”) and mark it for reference. Establish a zero vertical deflection point. From this point will be determined X coordinate movement.

Establish a zero deflection point at the upper most height and on each end of the assembly. From this point will be determined Y and Z coordinate movement.

Load the shelves with ten-pound sand or shot bags until each shelf is loaded with 40 lbs per sq ft not to exceed 200 pounds.
Record deflection at X, Y1, Y2 and Z.

### 6.4.2 Acceptance Criteria

Allowable maximum deflection
- \( X = 0.125 \) inches
- \( Y_{\text{avg}} \) (\( Y1 + Y2 \)/2) = 0.125 inches
- \( Z = 0.125 \) inches

### 6.4.3 Test Procedure Continued

With shelves fully loaded add the worksurface live load using fifty pound steel bars to the specified load category for worksurfaces.

Record deflection at X, Y1, Y2 and Z.

### 6.4.4 Acceptance Criteria

Allowable maximum deflection
- \( X = 0.250 \) inches
- \( Y_{\text{avg}} \) (\( Y1 + Y2 \)/2) = 0.125 inches
- \( Z = 0.125 \) inches

### 6.5 Stability Test Config. 1 (Single Sided, Cantilevered) - Anchored Units

Refer to Fig 6

### 6.5.1 Test Procedure Anchored Units

At the upper most point of the assembly apply a force at \( F_z \) equal to two percent of the systems fully loaded maximum.

Record deflection at X and Z.

### 6.5.2 Acceptance Criteria

Allowable maximum deflection
- \( X = 0.060 \) inches
- \( Z = 0.500 \) inches

### 6.6 Resistance to Overturning Config. 2 (Single Sided, Cantilevered) - Free Standing Units

### 6.6.1 Test Procedure Free Standing Units

Block the unit at front or rear bottom edge to prevent lateral movement. Tilt the unit 10 degrees from horizontal in the direction most likely to overturn.

### 6.6.2 Acceptance Criteria

A pass is when the unit does not initiate overturn when tilted 10 degrees from horizontal in the direction most likely to cause overturn and when no parts become disengaged from unit.

### 6.7 Strength Test Configuration 2 (Double Sided, Cantilevered)

Refer to Fig 7
6.7.1 Test Procedure

Measure the worksurface to find the center point (approximately at 36") and mark it for reference. Establish a zero vertical deflection point. From this point will be determined X coordinate movement. Establish an X coordinate on the opposite side equal to the location on facing side.

Establish a zero deflection point at the upper most height and on each end of the assembly. From this point will be determined Y and Z coordinate movement.

Load the shelves with ten-pound sand or shot bags until each shelf is loaded with 40 lbs per sq ft not to exceed 200 pounds. Load shall be applied evenly on both (facing side and opposite) sides for a balanced load.

Record deflection at X1, X2, Y1, Y2 and Z.

6.7.2 Acceptance Criteria

Allowable maximum deflection
X\text{avg} (Y + Y)/2 = 0.125 inches
Z = 0.125 inches

6.7.3 Test Procedure Continued

With shelves fully loaded add the worksurface live load using fifty pound steel bars to the specified load category for worksurfaces. Load shall be applied evenly on both (facing side and opposite) sides for a balanced load.

Record deflection at X1, X2, Y1, Y2 and Z.

6.7.4 Acceptance Criteria

Allowable maximum deflection
X1, X2 = 0.250 inches
Y\text{avg} (Y1 + Y2)/2 = 0.125 inches
Z = 0.125 inches

6.8 Stability Test Config. 2 (Double Sided, Cantilevered) – Anchored Units

Refer to Fig 8

6.8.1 Test Procedure Anchored Units

At the upper most point of the assembly apply a force at Fz equal to two percent of the systems fully loaded maximum.

Record deflection at X1, X2, and Z.

6.8.2 Acceptance Criteria

Allowable maximum deflection
X1, X2 = 0.063 inches
Z = 0.500 inches

6.9 Resistance to Overturning Configuration 2 (Double Sided, Cantilevered) Free Standing Units

6.9.1 Test Procedure Free Standing Units

Block the unit at front or rear bottom edge to prevent lateral movement. Tilt the unit 10 degrees from horizontal in the direction most likely to overturn.

6.9.2 Acceptance Criteria

A pass is when the unit does not initiate overturn when tilted 10 degrees from horizontal in the direction most likely to cause overturn and when no parts become disengaged from unit.
6.10 Strength Test Configuration 3 (Single Sided, Supported)

Refer to Figure 9

6.10.1 Test Procedure

Measure the worksurface to find the center point (approximately at 36") and mark it for reference.

Establish a zero vertical deflection point. From this point will be determined X coordinate movement.

Establish a zero deflection point at the upper most height and on each end of the assembly. From this point will be determined Y and Z coordinate movement.

Load the shelves with ten-pound sand or shot bags until each shelf is loaded with 40 lbs per sq ft not to exceed 200 pounds.

Record deflection at X, Y1, Y2 and Z.

6.10.2 Acceptance Criteria

Allowable maximum deflection

\[
X = 0.125 \text{ inches} \\
Y_{av} (Y^1 + Y^2)/2 = 0.125 \text{ inches} \\
Z = 0.125 \text{ inches}
\]

6.10.3 Test Procedure Continued

With shelves fully loaded add the worksurface live load using fifty pound steel bars to the specified load category for worksurfaces.

Record deflection at X, Y1, Y2 and Z.

6.10.4 Acceptance Criteria

Allowable maximum deflection

\[
X = 0.250 \text{ inches} \\
Y_{av} (Y^1 + Y^2)/2 = 0.125 \text{ inches} \\
Z = 0.125 \text{ inches}
\]

6.11 Stability Test Configuration 3 (Single Sided, Supported) - Anchored Units

Refer to Fig 10

6.11.1 Test Procedure Anchored Units

At the upper most point of the assembly apply a force at Fz equal to two percent of the systems fully loaded maximum.

Record deflection at X and Z.
6.11.2 Acceptance Criteria

Allowable maximum deflection
\[ X = 0.063 \text{ inches} \]
\[ Z = 0.500 \text{ inches} \]

6.12 Resistance to Overturning Config. 3 (Single Sided, Supported) Free Standing Units

6.12.1 Test Procedure Free Standing Units

Block the unit at front or rear bottom edge to prevent lateral movement. Tilt the unit 10 degrees from horizontal in the direction most likely to overturn.

6.12.2 Acceptance Criteria

A pass is when the unit does not initiate overturn when tilted 10 degrees from horizontal in the direction most likely to cause overturn and when no parts become disengaged from unit.

6.13 Strength Test Configuration 4 (Double Sided, Supported)

Refer to Fig 11

6.13.1 Test Procedure

Measure the worksurface to find the center point (approximately at 36") and mark it for reference. Establish a zero vertical deflection point. From this point will be determined X coordinate movement. Establish an X coordinate on the opposite side equal to the location on facing side.

Load the shelves with ten-pound sand or shot bags until each shelf is loaded with 40 lbs per sq ft not to exceed 200 pounds. Load shall be applied evenly on both (facing side and opposite) sides for a balanced load.

Record deflection at \( X_1, X_2, Y_1, Y_2 \) and \( Z \).

6.13.2 Acceptance Criteria

Allowable maximum deflection
\[ X_1, X_2 = 0.125 \text{ inches} \]
\[ Y_{avg} (Y_1 + Y_2)/2 = 0.125 \text{ inches} \]
\[ Z = 0.125 \text{ inches} \]

With shelves fully loaded add the worksurface live load using fifty pound steel bars to the specified load category for worksurfaces. Load shall be applied evenly on both (facing side and opposite) sides for a balanced load.

Record deflection at \( X_1, X_2, Y_1, Y_2 \) and \( Z \).

6.14 Stability Test Configuration 4 (Double Sided, Supported) – Anchored Units

Refer to Fig 12

6.14.1 Test Procedure

At the upper most point of the assembly apply a force at \( F_z \) equal to two percent of the systems...
fully loaded maximum.

Record deflection at X₁, X₂, and Z.

6.14.2 Acceptance Criteria

Allowable maximum deflection
X₁, X₂ = 0.063 inches
Z = 0.500 inches

6.15 Resistance to Overturning
Configuration 4 (Double Sided, Supported) Free Standing Units

6.15.1 Test Procedure Free Standing Units

Block the unit at front or rear bottom edge to prevent lateral movement. Tilt the unit 10 degrees from horizontal in the direction most likely to cause overturn and when no parts become disengaged from unit.

7.0 Product Testing

7.1 Forms

Configuration 1
Single Sided – Cantilevered

Configuration 2
Double Sided – Cantilevered

Configuration 3
Single Sided – Simply Supported

Configuration 4
Double Sided – Simply Supported

figure 12
CONFIGURATION 4
Double Sided - Supported Anchored Units

[i] Adapted from NSF/ANSI 49-2010
SEFA 10 - 2013
Test Report
Adaptable System

Class _____ per section 5.1-5.8

Configuration 1
Single Sided – Cantilevered

Load Category _______ per 6.3.2

Anchor Details:

________________________
________________________
________________________
________________________
________________________
________________________

Shelving:

Shelf is:  [ ] Continuous  [ ] Split

Shelf Material

Shelf size:  

ft x ft = sq.ft.

x 40 lb = each

Shelf live load

Continuous Shelves x 2 = lbs

or

Split Shelves x 4 = lbs

Total shelf load

Work surface:

Work Surface Load Category:

<table>
<thead>
<tr>
<th>CAT 1</th>
<th>CAT 2</th>
<th>CAT 3</th>
<th>CAT 4</th>
<th>Other</th>
</tr>
</thead>
<tbody>
<tr>
<td>200 lb</td>
<td>600 lb</td>
<td>1000 lb</td>
<td>1200 lb</td>
<td></td>
</tr>
</tbody>
</table>

Table 1

Work surface load

+ Total shelf load

Fully loaded maximum

x 0.02

Fz Applied Load

6.4 Strength Test Configuration 1 (Single Sided, Cantilevered)

6.4.2

X  [ ] Pass  [ ] Fail

Yavg  [ ] Pass  [ ] Fail

Z  [ ] Pass  [ ] Fail

6.4.4

X  [ ] Pass  [ ] Fail

Yavg  [ ] Pass  [ ] Fail

Z  [ ] Pass  [ ] Fail

6.5 Stability Test Configuration 1 (Single Sided, Cantilevered) Anchored Units

6.5.2

X  [ ] Pass  [ ] Fail

Z  [ ] Pass  [ ] Fail

6.6 Resistance to Overturn Configuration 1 (Single Sided, Cantilevered) Free Standing Units

6.6.2

[ ] Pass  [ ] Fail
SEFA 10 - 2013
Test Report
Adaptable System

Class _____ per section 5.1-5.8

Configuration 2
Double Sided – Cantilevered

Load Category _______ per 6.3.2

Anchor Details:
________________________________________
________________________________________
________________________________________
________________________________________
________________________________________

Shelving:
Shelf is: [ ] Continuous  [ ] Split
Shelf Material ____________________________

Shelf size:
[ ] ft x [ ] ft = [ ] sq.ft.
× 40 lb = [ ] each Shelf live load

Continuous Shelves x 4 = [ ] lbs
or
Split Shelves x 8 = [ ] lbs
Total shelf load

Work surface:

<table>
<thead>
<tr>
<th>Work Surface Load Category:</th>
</tr>
</thead>
<tbody>
<tr>
<td>CAT 1</td>
</tr>
<tr>
<td>400 lb</td>
</tr>
</tbody>
</table>

Table 1

<table>
<thead>
<tr>
<th>Work surface load</th>
<th>+ Total shelf load</th>
<th>Fully loaded maximum</th>
<th>x 0.02 Fz Applied Load</th>
</tr>
</thead>
</table>

6.7 Strength Test Configuration 2 (Double Sided, Cantilevered)
6.7.2

X [ ] Pass [ ] Fail
Yavg [ ] Pass [ ] Fail
Z [ ] Pass [ ] Fail

6.7.4

X [ ] Pass [ ] Fail
Yavg [ ] Pass [ ] Fail
Z [ ] Pass [ ] Fail

6.8 Stability Test Configuration 2 (Double Sided, Cantilevered) Anchored Units
6.8.2

X [ ] Pass [ ] Fail
Z [ ] Pass [ ] Fail

6.9 Resistance to Overturn
Configuration 2 (Double Sided, Cantilevered)
Free Standing Units
6.9.2

[ ] Pass [ ] Fail
SEFA 10 - 2013
Test Report
Adaptable System

Class _____ per section 5.1-5.8

Configuration 3
Single Sided – Simply Supported

Load Category _______ per 6.3.2

Anchor Details:
________________________________________
________________________________________
________________________________________
________________________________________
________________________________________

Shelving:
Shelf is:  □ Continuous □ Split
Shelf Material  

Shelf size:  

ft x ft = sq.ft.
 x 40 lb = each Shelf live load

Continuous Shelves x 2 = lbs

or

Split Shelves x 4 = lbs

Total shelf load

Work surface:

<table>
<thead>
<tr>
<th>Work Surface Load Category:</th>
</tr>
</thead>
<tbody>
<tr>
<td>CAT 1</td>
</tr>
<tr>
<td>200 lb</td>
</tr>
</tbody>
</table>

Table 1

Work surface load

+ Total shelf load

Fully loaded maximum

x 0.02

Fz Applied Load

6.10 Strength Test Configuration 3 (Single Sided, Supported)
6.10.2

X  □ Pass  □ Fail

Yavg  □ Pass  □ Fail

Z  □ Pass  □ Fail

6.10.4

X  □ Pass  □ Fail

Yavg  □ Pass  □ Fail

Z  □ Pass  □ Fail

6.11 Stability Test Configuration 3 (Single Sided, Supported) Anchored Units
6.11.2

X  □ Pass  □ Fail

Z  □ Pass  □ Fail

6.12 Resistance to Overturn
Configuration 3 (Single Sided, Supported) Free Standing Units
6.12.2

□ Pass  □ Fail
SEFA 10 - 2013
Test Report
Adaptable System

Class _____ per section 5.1-5.8

Configuration 4
Double Sided – Simply Supported

Load Category ______ per 6.3.2

Anchor Details:
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________

Shelving:

Shelf is:  [ ] Continuous  [ ] Split
Shelf Material ____________________________________________

Shelf size:  

ft x ft = sq.ft.

x 40 lb = each Shelf live load

Continuous Shelves x 4 = lbs

Split Shelves x 8 = lbs

Total shelf load

Work surface:

Work Surface Load Category:

<table>
<thead>
<tr>
<th>Work Surface Load Category:</th>
</tr>
</thead>
<tbody>
<tr>
<td>CAT 1</td>
</tr>
<tr>
<td>400 lb</td>
</tr>
</tbody>
</table>

Table 1

Work surface load

+ Total shelf load

Fully loaded maximum

x 0.02

Fz Applied Load

6.13 Strength Test Configuration 4 (Double Sided, Supported)

6.13.2

X  [ ] Pass  [ ] Fail

Yavg  [ ] Pass  [ ] Fail

Z  [ ] Pass  [ ] Fail

6.13.4

X  [ ] Pass  [ ] Fail

Yavg  [ ] Pass  [ ] Fail

Z  [ ] Pass  [ ] Fail

6.14 Stability Test Configuration 4 (Double Sided, Supported) Anchored Units

6.14.2

X  [ ] Pass  [ ] Fail

Z  [ ] Pass  [ ] Fail

6.15 Resistance to Overturn

Configuration 1 (Single Sided, Cantilevered)
Free Standing Units

6.15.2

[ ] Pass  [ ] Fail
### APPENDIX A

**CLASS ADAPTABILITY RATING CHART**

**How to use these charts:**
Each Class is given a numerical range (low to high) for each function. Different configurations of each system can have an impact on a particular function. The Total Point score establishes the Class designation.

**POINTS DEFINITION**
- 0 = Requires new components
- 1 = Requires trade contractors & casework installation personnel
- 2 = Requires casework installation personnel
- 3 = Can be accomplished with facility personnel
- 4 = Can be accomplished by the end user

#### ADAPTABILITY RATING CHART

<table>
<thead>
<tr>
<th>Action</th>
<th>Class 1</th>
<th>Class 2</th>
<th>Class 3</th>
<th>Class 4</th>
<th>Class 5</th>
<th>Class 6</th>
<th>Class 7</th>
<th>Class 8</th>
</tr>
</thead>
<tbody>
<tr>
<td>Relocate a Cabinet</td>
<td>1–2</td>
<td>3–3</td>
<td>2–4</td>
<td>2–4</td>
<td>2–4</td>
<td>2–4</td>
<td>2–4</td>
<td>3–4</td>
</tr>
<tr>
<td>Relocate a Bench</td>
<td>1–2</td>
<td>1–3</td>
<td>2–3</td>
<td>2–3</td>
<td>2–3</td>
<td>4–4</td>
<td>3–4</td>
<td>4–4</td>
</tr>
<tr>
<td>Adjust a Worksurface</td>
<td>0–0</td>
<td>3–4</td>
<td>2–3</td>
<td>2–4</td>
<td>3–4</td>
<td>3–4</td>
<td>3–3</td>
<td>3–4</td>
</tr>
<tr>
<td>Add a Shelf</td>
<td>2–4</td>
<td>2–4</td>
<td>4–4</td>
<td>4–4</td>
<td>4–4</td>
<td>4–4</td>
<td>4–4</td>
<td>4–4</td>
</tr>
<tr>
<td>Adjust a Shelf</td>
<td>2–4</td>
<td>3–4</td>
<td>4–4</td>
<td>4–4</td>
<td>4–4</td>
<td>4–4</td>
<td>4–4</td>
<td>4–4</td>
</tr>
<tr>
<td>Relocate a Utility</td>
<td>1–1</td>
<td>1–1</td>
<td>1–1</td>
<td>1–1</td>
<td>1–1</td>
<td>1–1</td>
<td>3–4</td>
<td>3–4</td>
</tr>
</tbody>
</table>

**Adaptability Range**
- 7–13
- 13–19
- 15–19
- 15–20
- 16–20
- 18–21
- 19–23
- 21–24
## Appendix B

### Class Functionality Rating Chart

<table>
<thead>
<tr>
<th>Action</th>
<th>Class 1</th>
<th>Class 2</th>
<th>Class 3</th>
<th>Class 4</th>
<th>Class 5</th>
<th>Class 6</th>
<th>Class 7</th>
<th>Class 8</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cleanability</td>
<td>3–4</td>
<td>1–3</td>
<td>1–3</td>
<td>1–3</td>
<td>1–3</td>
<td>1–3</td>
<td>2–3</td>
<td>1–3</td>
</tr>
<tr>
<td>Storage Volume</td>
<td>4–4</td>
<td>1–3</td>
<td>1–3</td>
<td>1–3</td>
<td>1–3</td>
<td>1–3</td>
<td>1–3</td>
<td>1–3</td>
</tr>
<tr>
<td>Strength – Overall</td>
<td>4–4</td>
<td>2–3</td>
<td>2–4</td>
<td>3–4</td>
<td>2–4</td>
<td>2–3</td>
<td>2–3</td>
<td>2–4</td>
</tr>
<tr>
<td>Strength – Work Surface</td>
<td>1–4</td>
<td>1–4</td>
<td>1–4</td>
<td>1–4</td>
<td>1–4</td>
<td>1–4</td>
<td>1–4</td>
<td>1–4</td>
</tr>
<tr>
<td>Stability – Tipping</td>
<td>0–1</td>
<td>0–1</td>
<td>0–1</td>
<td>0–1</td>
<td>0–1</td>
<td>0–1</td>
<td>0–1</td>
<td>0–1</td>
</tr>
</tbody>
</table>

### Points Definition

#### Cleanability
- **1** = System creates multiple gaps and hard to reach surfaces
- **2** = Multiple gaps — surfaces reachable
- **3** = Sealed worksurfaces and toespaces — reachable worksurfaces with minor gaps
- **4** = Sealed worksurfaces and toespaces — all surfaces reachable and sealed

#### Storage Volume
- **1** = Prohibits storage units — allows for shelves only
- **2** = Restricted by suspended unit sizing for fit within system components
- **3** = Restricted by base unit sizing to fit under suspended surfaces
- **4** = Utilizes full volume of bench space available

#### Stability – Overturn
- **0** = Fail
- **1** = Pass

#### Strength – Overall

**Single Sided (Worksurface & Shelves)**
- **0** = Less than 600 pounds
- **1** = 600 pounds
- **2** = 1000 pounds
- **3** = 1400 pounds
- **4** = Over 1400 pounds

**Double Sided (Worksurface & Shelves)**
- **0** = Less than 1200 pounds
- **1** = 1200 pounds
- **2** = 2000 pounds
- **3** = 2800 pounds
- **4** = Over 2800 pounds

#### Strength – Work Surface
- **1** = 200 pounds
- **2** = 600 pounds
- **3** = 1000 pounds
- **4** = Over 1000 pounds
# Table Of Contents

<table>
<thead>
<tr>
<th>Committee Members</th>
<th>352</th>
<th>6.0 Location</th>
<th>357</th>
</tr>
</thead>
<tbody>
<tr>
<td>Foreword</td>
<td>353</td>
<td>7.0 Installation</td>
<td>358</td>
</tr>
<tr>
<td>Sections</td>
<td></td>
<td>8.0 Storage Recommendations</td>
<td>358</td>
</tr>
<tr>
<td>1.0 Scope</td>
<td>354</td>
<td>8.1 General</td>
<td></td>
</tr>
<tr>
<td>2.0 Purpose</td>
<td>354</td>
<td>8.2 Acid Storage</td>
<td></td>
</tr>
<tr>
<td>3.0 Definitions</td>
<td>354</td>
<td>8.3 Base Storage</td>
<td></td>
</tr>
<tr>
<td>4.0 Construction</td>
<td>355</td>
<td>8.4 Flammable/Solvent Storage</td>
<td></td>
</tr>
<tr>
<td>4.1 Flammable/Solvent Storage Cabinets</td>
<td></td>
<td>8.5 Peroxide Forming Chemical Storage</td>
<td></td>
</tr>
<tr>
<td>4.1.1 Purpose</td>
<td></td>
<td>8.6 Water Reactive Chemical Storage</td>
<td></td>
</tr>
<tr>
<td>4.1.2 Construction</td>
<td></td>
<td>8.7 Oxidizer Storage</td>
<td></td>
</tr>
<tr>
<td>4.1.3 Venting</td>
<td></td>
<td>8.8 Toxic Components</td>
<td></td>
</tr>
<tr>
<td>4.1.4 Filtered Storage Cabinets</td>
<td></td>
<td>9.0 Reference Sources</td>
<td>360</td>
</tr>
<tr>
<td>4.2 Hazardous Storage Cabinets</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4.2.1 Purpose</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4.2.2 Construction</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4.2.3 Venting</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4.2.4 Filtered Storage Cabinets</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5.0 Requirements (testing)</td>
<td>357</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5.1 Flammable Storage Cabinets</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5.2 Hazardous Storage Cabinets</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5.3 Shelf Loads</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
SEFA 11—Liquid Chemical Storage Committee Members

Co-Chairs
Sascha Kunkel - asecos GmbH
Gregory Rice - JUSTRITE Mfg., L.L.C.,

Air Master Systems
HKS Architects
Institutional Casework
Scientific Plastics
Foreword

SEFA Profile

The Scientific Equipment and Furniture Association (SEFA) is an international trade association comprised of manufacturers of laboratory furniture, casework, fume hoods and members of the design and installation professions. The Association was founded to promote this rapidly expanding industry and improve the quality, safety and timely completion of laboratory facilities in accordance with customer requirements.

SEFA Recommended Practices

SEFA and its committees are active in the development and promotion of Recommended Practices having domestic and international applications. Recommended Practices are developed by the association taking into account the work of other standard-writing organizations. Liaison is also maintained with government agencies in the development of their specifications.

SEFA’s Recommended Practices are developed in and for the public interest. These practices are designed to promote a better understanding between designers, architects, manufacturers, purchasers, and end-users and to assist the purchaser in selecting and specifying the proper product to meet the user’s particular needs. SEFA’s Recommended Practices are periodically updated. The Recommended Practices are numbered to include an annual suffix which reflects the year that they were updated. SEFA encourages architects to specify these Recommended Practices as follows: “SEFA 11-2012”.

SEFA Glossary of Terms

SEFA has developed a Glossary of Terms (SEFA 4-2010) for the purpose of promoting a greater understanding between designers, architects, manufacturers, purchasers and end users. The terms defined by SEFA are frequently used in contracts and other documents, which attempt to define the products to be furnished or the work involved. The Association has approved this Glossary in an effort to provide uniformity among those who use these terms. Where a specific Recommended Practice contains definitions which differ from those in the Glossary of Terms, then the definitions in the specific Recommended Practice should be used.

SEFA encourages all interested parties to submit additional terms or to suggest any changes to those terms already defined by the Association. The definitions should be used to help resolve any disputes that may arise or to incorporate the applicable terms in any contract or related documents.

SEFA Disclaimer

SEFA uses its best effort to promulgate Recommended Practices for the benefit of the public in light of available information and accepted industry practices. SEFA does not guarantee, certify, or assure the safety or performance of any products, components, or systems tested, installed, or operated in accordance with SEFA Recommended Practices or that any tests conducted under its Recommended Practices will be non-hazardous or free from risk. SEFA encourages the use of third party independent testing where appropriate.

Note: Testing as described in this document must be performed and documented by a SEFA-approved third party testing facility. See Page 34 of the SEFA Desk Reference 5th Edition Version 2.0, or visit us at SEFALABS.COM for the most current list of SEFA-approved test labs.

© SEFA - 5th Edition Desk Reference - Version 2.0
1.0 Scope

These Recommended Practices apply to Liquid Chemical Storage Cabinets located in Laboratories. This document includes discussions of Flammable and Combustible cabinets, Explosion-proof refrigerators, Filtered Storage Cabinets, Acid storage, Base storage, and Corrosives.

These Recommended Practices are intended to be used to supplement the knowledge of a trained qualified professional. National, State or Local Codes always take precedence and should be observed.

2.0 Purpose

This document is intended to provide end users and planners with information on the type of storage cabinet required, construction, installation and the basic considerations to determine which chemicals should be stored together and which chemicals should not be stored together in the Laboratory.

3.0 Definitions

**Acid compound** – Any of a class of compounds that in aqueous solution turns blue litmus red and reacts with bases and a with certain metals to form salts. A compound that dissociates in a solvent to produce the positive (+) ion of the solvent.

**Acid Storage Cabinets** – Cabinets in which Acids are stored to avoid having large quantities of hazardous material in the laboratory work area. This reduces the risk of injury or damage to the work area of the laboratory.

**Approved** – Acceptable to the authority having jurisdiction.

**Authority Having Jurisdiction** – An organization, office or individual responsible for enforcing the requirements of a code or standard, or for approving equipment, materials, and installation, or a procedure.

**Base compound** – (an Alkali) A compound that is capable of so uniting with an acid as to neutralize its acid properties and form a salt. A compound that yields hydroxyl (-) ions in solution.

**Base Storage Cabinets** – Cabinets in which bases are stored to avoid having large quantities of hazardous material in the laboratory work area.

**Combustible liquid** – Class II liquids - Liquids with a flash point greater than 100 degrees F but below 140 degrees F. OSHA 1910.106(a)(18)-. Class III have flashpoints above 140 degrees F.

**Explosion-proof refrigerators** - Refrigerators and/or freezers designed to prevent ignition of flammable vapors inside the storage compartment.

**Filtered Storage Cabinet** – Continuously vented chemical storage cabinet equipped with its own filtration and ventilation device designed to eliminate the propagation and accumulation of manufacturer pre-approved and verified toxic contaminants. A filtered storage cabinet is typically not attached to any external exhaust system. Existing filtration standards pertaining to Filtered storage cabinets: AFNOR NFX 15-211 (Filtration efficiency requirements only).

**Fire Area** – 1910.106(a)(12) A Fire Area is defined as an area of a building separated from the rest of the building by construction having a fire resistance rating of at least 1 hour and having all communicating openings properly protected by an assembly having a fire protection rating of at least 1 hour.

**Flammable liquids** – Class I Liquids - Liquids that form flammable vapors at temperatures below 100 degrees F (hot Summer day). At room temperatures, extremely flammable liquids form vapor below 73 degrees F.

**Flammable/Solvent storage cabinets** – Cabinets in which heat ignitable materials are stored to prevent exposure to ignition sources and restrict access to unauthorized personnel.

**Flashpoint** – Flashpoint means the minimum temperature at which a liquid gives off vapor
within a test vessel in sufficient concentration to form an ignitable mixture with air near the surface of the liquid.

**Hazardous Storage Cabinets** – General term for cabinets that restrict access to chemicals that might be harmful or dangerous to students or other personnel not qualified to have access. These chemicals may include but are not limited to Corrosives, Acids, Bases and other chemicals found in Laboratory.

**Laboratory work area** – The main area of the laboratory where chemicals are used during experiments, testing or teaching.

**Litmus** – A blue dyestuff made by fermenting certain coarsely powdered lichens. It is turned red by acids and remains blue when treated with an alkali.

**May** - When used indicates an alternate requirement or option.

**Poison** – General term for chemicals that can injure or kill by ingestion or contact.

**Preparation Room** – Room usually located adjacent to the laboratory for preparing chemical compounds and experiments to be used in the laboratory. Chemical storage cabinets are usually located in the preparation room.

**Shall** - Where used, indicates a mandatory requirement.

**Should** – Where used indicates recommendation.

**Solvent** – Substance that dilutes or disperses another substance. Ranging from water and air to complex hydrocarbons.

**Vent** – Ducting or piping system designed to remove or change the air in an enclosed space like storage cabinets.

### 4.0 Construction

#### 4.1 Flammable/Solvent Storage Cabinets

##### 4.1.1 Purpose

The purpose of Flammable/Solvent Storage cabinets is to delay flammable liquids from exposure to heat in case of fire. A secondary function is to restrict access to the flammable liquids by students and other personnel not qualified to have access. Flammable storage cabinets should be locked.

Flammable/Solvent Storage cabinets may also contain combustible liquids. Liquids stored in a cabinet should be mutually compatible.

Flammable/Solvent Storage cabinets are designed and constructed for Flammable and combustible liquid storage only. They are not intended for the storage of small cylinders of compressed or liquefied gases, especially those that are flammable. Likewise, incompatible materials, whether liquid or solid, should not be stored in these cabinets.

##### 4.1.2 Construction

Flammable/Solvent Storage cabinets shall meet the requirements of **NFPA 30** and **NFPA #1**. No self-closing door(s) are required, doors may be hinged on each side. Cabinets should be clearly marked with a conspicuous label in red letters on contrasting background that reads:

**FLAMMABLES – KEEP FIRE AWAY**  
(Ref. UL 1275)

Cabinets should be independent third party tested to meet the requirements of one of the following certifying agencies: UL-Underwriters Laboratories, FM-Factory Mutual, ULC-Underwriters Laboratories of Canada.

##### 4.1.3 Venting

Cabinets are not required to be vented for fire protection purposes; however, the following shall apply:
a) When the cabinet is vented it shall be done in such a manner that will not compromise the specified performance of the cabinet, as acceptable to the authority having jurisdiction.

b) For non-vented flammable storage cabinets, it is recommended that the vent openings shall be sealed with the bungs supplied with the cabinet or with bungs specified by the manufacturer of the cabinet. If the authority having jurisdiction determines that the cabinet must be vented, then these procedures should be considered:

a) Remove both metal bungs and replace with flash arrestor screens (normally provided with the cabinets). The top opening will serve as a fresh air inlet.

b) Connect the bottom opening to an exhaust fan by a substantial metal tubing having and inside diameter no smaller then the vent. The tubing should be rigid steel. It should be also insulated, and exhaust directly outside.

c) The fan should have a non-sparking fan blade and non-sparking shroud and shall comply with NFPA 91, (Standard for Exhaust Systems for Air Conveying of Vapors, Gases, Mists, and Non-Compatible Particulate Solids).

d) The total duct of the exhaust duct should not exceed 25 feet

NOTE: Local codes vary from one area to another and may require extra work to be performed, such as California's seismic requirements. It is important to be familiar with, and adhere closely to all such codes and requirements as the authority having jurisdiction deems necessary.

4.1.4 Filtered Storage Cabinets

Filtered storage cabinets shall only be recommended for use with manufacturer approved and pre-verified applications that meet the filtration efficiency requirements of the AFNOR NFX 15-211 Class II standard. Filtered storage cabinets shall also comply with the following sections of SEFA 9:

- 4.1.2 Category II
- 4.2 Manufacturer approved applications
- 4.2.1 Manufacturer’s Handbook
- 5.1 Safe work practices
- 5.2 Recommended usage precautions

Special care should be taken to make sure that compatible storage is provided to separate incompatible materials. Note: Before specifying any chemical or hazardous storage cabinet, familiarize yourself with all local and state codes from the appropriate agencies having jurisdiction in that area.

4.2 Hazardous Storage Cabinet

4.2.1 Purpose

The purpose of a Hazardous Storage Cabinet is to restrict the access to chemicals that might be harmful or dangerous to students or other personnel not qualified to have access and/or to provide an appropriate corrosive resistant environment for storage of hazardous materials. Also cabinets should and shall be designed such that in case of an accidental spill the cabinet will safely contain the spill. These chemicals may include but are not limited to Corrosives, Acids, Bases, Oxidizers, Poisons and other chemicals not of a Flammable or Combustible nature.

4.2.2 Construction

The interior of the cabinet shall be treated, coated or constructed of materials that are not reactive with the chemical being stored. The secondary containment trough shall be constructed with the same chemical resistance and with a depth of 2” minimum.

Doors may be provided with a suitable means of locking and securing the cabinet. This locking mechanism must be compatible with the chemical being stored.

The use of Metal Fasteners and shelf supports inside cabinet must have the same chemical resistance as the interior of the cabinet.

Cabinets should be clearly marked with a minimum 2” letters and so identified with the
chemical that is being stored. E.g., ACIDS, BASES, POISONS, etc.

Hazardous Storage Cabinets shall be so designed that all chemicals are not stored above shoulder height with the over all cabinet height of not more then 65”. Special care shall be taken to secure tall cabinets to walls. Special care shall be taken to provide seismic anchorage as required per local codes.

If vented, cabinet should be vented from the bottom since most Hazardous Vapors are heavier than air, however lighter than air chemicals need vents located at the top of the cabinet. This venting shall not compromise the ability for the cabinet to contain a spill should one occur inside the cabinet. Also a mechanical exhaust ventilation is preferred and it should comply with NFPA 91.

The installation of the vent into the ductwork of a fume hood exhaust is preferred.

4.2.3 Venting Hazardous Storage Cabinets

Venting is recommended to exhaust noxious fumes that may build-up in an enclosed acid storage cabinet, and cause discomfort and/or compromise the respiratory health of laboratory personnel. When a plastic product for venting of cabinets is specified, it is recommended that polyolefin pipe be used. See ASTM 1412. PVC piping should not be used for venting, as it will burn black if ignited and produce chlorine gas.

4.2.4 Explosion Proof Refrigerators

Explosion-proof refrigerators are designed for use in an area where flammable vapors or gases may be present in the environment around the unit. They have sealed electrical equipment and junction boxes that eliminate ignition sources outside and inside the unit. Explosion-proof refrigerators require special hazardous-location wiring rather than simple cord-and-plug connections. They must be hard-wired into the buildings electrical system using approved methods. Laboratory refrigerators should also be labeled “No Food” or “Food Only,” depending on their use. Food shall never be stored or consumed near chemicals.

Using previously modified refrigerators is acceptable if the laboratory inspects them regularly for defects such as frayed wiring. Defective refrigerators shall not be used to store flammable materials. Typical laboratory operations would not warrant an explosion proof refrigerator, if you believe you have a need for an “explosion-proof” refrigerator it is recommended that you contact your local Fire Marshal.

5.0 Requirements

5.1 Flammable Storage Cabinets

Flammable storage cabinets shall meet the manufacturing specifications of the NFPA # 30 and NFPA #1. Cabinets should be independently third party tested by one of the following certifying agencies:

- UL - Underwriters Laboratories
- FM - Factory Mutual
- ULC - Underwriters Laboratories of Canada

or an agency acceptable to the authority having jurisdiction.

5.2 Hazardous Storage Cabinets

Hazardous Storage Cabinets should be approved as being acceptable by the authority having jurisdiction.

5.3 Shelf Loads

See SEFA 8 Section 7.0 Shelving

6.0 Location

Liquid Chemical Storage Cabinets shall be in an area of the laboratory with low traffic away from the main work area. It is important to segregate incompatible chemicals. Eliminate ignition sources such as open flame, hot surfaces, electrical equipment, or static electricity from the storage area. Make sure appropriate fire extinguishers and/or sprinkler systems are in the area. An eyewash and safety shower must be readily accessible to areas where liquid chemicals are stored, per OSHA 1910.106(d)(3)(I).
Do not store chemicals in Fume hoods or under sinks where there may be exposure to water. Do not store chemicals on bench tops. Such storage is more vulnerable to accidental breakage by laboratory, housekeeping, and emergency response personnel. Never store chemicals on the floor.

7.0 Installation

Installation shall be performed by an experienced laboratory equipment installer. Metal cabinets should be securely installed and grounded when necessary; if chemicals are being dispensed directly from a cabinet then the container must also be grounded.

8.0 Storage Recommendations

In developing a storage plan many factors must be considered: types of materials to be stored, quantities, sensitivity to sunlight, moisture, and other chemicals. Some different types of acids shouldn’t be stored together. Some chemicals require special allowances for venting and special caps that will vent in case of gas pressure build up. The following should be helpful in establishing a chemical storage plan.

8.1 General

1) Store chemicals that are compatible and of the same hazard class. Flammables should be stored with flammables and oxidizers with oxidizers.

2) Do not expose chemicals to direct sunlight and keep them away from area heaters or heat sources.

3) Corrosive chemicals should be stored in plastic trays large enough to contain spills and leaks.

4) Label all chemicals by name and concentration, include dates received and date opened.

5) Do not store hazardous chemicals higher than 60" above the finished floor.

6) Solid chemicals should be separated from liquids.

7) Chemicals should not be stored under sinks or in fume hoods.

8) Never store flammable liquids in un-fire-rated refrigerators. These refrigerators contain ignition sources that may cause sparks.

9) Never store chemicals and food in the same refrigerator.


11) Flammables should never be stored with Corrosives (ACIDS/BASES)

8.2 Acid Storage

1) Store large bottles of acids on lower shelves of acid storage cabinets.

2) Oxidizing acids should be stored separately from organic acids, flammables, and combustible materials.

3) Acids should be stored separately from bases and active metals like sodium, magnesium, and potassium.

4) Keep acids separated from chemicals that can generate toxic gases on contact, such as sodium cyanide and iron sulfide.

5) Store Acids in chemical resistant trays that are capable of containing any spillage or leakage.

6) Some acids are incompatible and should be stored separately.

7) Never store cyanides with acids or oxidizers.

8.3 Base Storage

1) Store Bases and Acids separately.

2) Large bottles of bases should be stored on lower shelves or in a corrosive cabinet.
3) Store Bases in chemical resistant trays that are capable of containing any spillage or leakage.

4) Some bases are incompatible and should be stored separately.

8.4 Flammable/Solvent Storage

1) According to NFPA 30 & 45 for each area with flammable liquids, you may store 10gal/100 sq.ft. in an unsprinklered lab or 20 gal/100sq.ft. in a sprinklered lab.

2) The maximum allowable quantity for flammable liquid storage in any size lab is not to exceed 120 gallons.

3) Always store flammables in approved enclosures. NFPA 30

4) Only explosion-proof or intrinsically safe refrigerators and freezers should be used for storing flammable liquids.

5) Always be aware of static electricity when transferring flammable liquids from one container to another, especially metal containers. Metal flammable storage cabinets should be grounded.

6) Make sure that all flammables stored together are compatible.

7) Review NFPA guidelines for flammable storage.

8.5 Peroxide Forming Chemical Storage

1) Peroxide forming chemicals should be stored in airtight containers in a dark, cool, and dry place.

2) Peroxide forming chemicals should be properly disposed of before the date of expected peroxide formation (six months after opening).

3) Make sure that all peroxide forming chemicals are stored by compatibility.

4) Shock sensitive and detonable materials are to be stored in secondary containers large enough to hold the container contents in case of breakage; i.e., picric and perchloric acids.

5) Picric, if dry, must remain dry; if wet, it must remain wet. Crystal formation on caps, etc., poses an imminent danger. Containers should be routinely inspected for peroxide formation. Chemicals should be labeled with date received, date opened, and disposal/expiration date.

6) Suspicion of peroxide contamination should be immediately investigated.

8.6 Water Reactive Chemical Storage

1) Water Reactive chemicals should be stored in a cool and dry place.

2) Make sure that all water reactive chemicals are stored by compatibility.

8.7 Oxidizer Storage

1) Oxidizers should be stored away from flammables, combustibles, and reducing agents (e.g. zinc, alkaline metals, etc.)

2) Make sure that all oxidizers are stored by compatibility.

3) Never store cyanides with acids or oxidizers.

8.8 Toxic Compounds

1) Toxic compounds should be stored according to the nature of the chemical, with the appropriate security employed when necessary.

2) A “Poison Control Network” telephone number should be posted in the laboratory along with CDC contact information. (Center for Disease Control)

3) Make sure that all toxins are stored by compatibility.

Note! Care must also be taken when disposing of materials. Separate waste containers should be used for each type of waste.
9.0 Reference Sources

1) **Webster’s Dictionary, Deluxe Edition 1992**

2) **EPA Uniform Fire Code**

3) **NFPA 30, National Fire Protection Agency, 2003**

4) **NFPA 91, National Fire Protection Agency, Standard for Exhaust Systems for Air Conveying of Vapors, Gases, Mists, and Non-Compatible Particulate Solids**

5) **NFPA 45, National Fire Protection Agency, 2004**

6) **NFPA 70, National Electric Code.**

7) **NFPA 42, 12.2.2 National Electric Code.**

8) **OSHA 1910.106, Occupational Safety and Health Administration**

9) **Medical College of Georgia and University of Waterloo**

10) **University of California, Berkley, Office of Environment, Health & Safety (EH&S Fact Sheet 2003)**

11) **AFNOR NFX 15-211 Filtration Efficiency Standard (Filtration efficiency portions only)**


13) **UFC 79**

14) **UL 1275**

15) **FM (Factory Mutual) Specification 2002 (Dated December 1996)**
The Scientific Equipment & Furniture Association acknowledges the generous support of our advertisers.

To place your Company’s Ad in the Desk Reference contact SEFA Headquarters - info@sefalabs.com
Since 1898, Sheldon Laboratory Systems, Inc. has set the standard for innovation and quality in elementary, middle school, high school and college laboratories. Our team’s passion for service in all that we do ensures the most innovative and reliable products always delivered on time and complete. Our extensive lab planning services will help you maximize available space and provide safe, effective and attractive learning environments.
Modular laboratories – your lab for the future

Ultra-flexibility for everyday laboratory use. Waldner service ceilings, used in conjunction with our SCALA laboratory furniture system, provide the ideal basis and can be adapted quickly and simply to new working conditions with complete freedom in terms of the arrangement of space and work stations.

This adaptability of room layout considerably extends the service life of your laboratory furniture.

Laboratory solutions
Made in Germany

WALDNER Laboreinrichtungen GmbH & Co. KG
Haidoesch 1 - 88239 Wangen - Germany
Phone +49 7522 986-480 · Fax +49 7522 986-418
info@waldner-lab.com · www.waldner-lab.com
SCI-FAB
by Kloppenberg
Quality Stainless Steel Lab Furnishings for the Research Environment

Sturdy & wear resistant laboratory furnishings for:
- Life & Animal Sciences
- Chemistry
- Health Care & OR
- Pharmaceutical
- Spectroscopy
- Necropsy

Built to your specifications to our high standards:
- Countertops & Tables
- Acid Cabinets
- Casework
- High-Density Storage
- Mobile Carts
- Hoods
- Pass-thru Cabinets
- Modular Wall Panels

Made in the US
100% Recyclable Material

SEFA Tested & Approved
Www.kloppenberg.com

The Kloppenberg Advantage

SCI-FAB by Kloppenberg
Made in the US
100% Recyclable Material
SEFA Tested & Approved
Www.kloppenberg.com
The Kloppenberg Advantage
World Class
Laboratory Furniture Systems

World Class Institutions

Life Science Plaza
M.D. Anderson Cancer Center, Houston, TX
Featuring A.T. Villa’s Ergolab™ system with basic fixed steel casework.

Wisconsin Institute for Medical Research, Tower II
University of Wisconsin, Madison, WI
Featuring the A.T. Villa Forte™ system with Basic fixed steel casework.

www.atvilla.com
If you need essential lab furniture at a moment’s notice*, VWR® REDISHIP is your source. Our fast-track inventory program ensures delivery of top-quality furniture items in a matter of days, helping you operate without interruption.

VWR REDISHIP also includes carts, tables, shelving, task lighting, and much more.

For complete information on VWR REDISHIP, or to learn more about VWR Furniture services, contact your VWR Furniture Specialist at 800.932.5000 or visit vwr.com/rediship.

VWR Furniture | designed • delivered • installed

*Most REDISHIP items ship within 3-5 business days of order. All items are subject to availability at time of order. Large quantity orders may require longer lead times. 3-5 business days shipping time is based on immediate credit approval and approved drawings.
INSTITUTIONAL CASEWORK INC. is uniquely positioned to provide your complete project package with painted or stainless steel, sustainable or custom wood laboratory & science casework, work surfaces, equipment, fixtures & fume hoods.

Eagle MHC – Your Equipment & Furniture Source

Stainless Steel...

Mobile Carts
Lab Sinks

Quad-Adjust®

Add to your existing shelving without having to disassemble the entire unit.

QuadPLUS®

Mats snap in place!

Quad-Adjust® wire truss frame
removable shelf mats shown with Quad-Adjust® wire truss frame

Hand Sinks | Lab Sinks | Worktables | Stainless Steel Countertops | Shelving Security Cages | High Density Shelving Systems | Utility Carts | Wall Shelves
Most Extensive Line of Laboratory Fume Hoods in the Industry

Uniflow Laboratory Fume Hoods

1. Constant Air Volume CAV Air By-Pass
2. Variable Air Volume VAV Restricted Bypass
3. Explosion Proof models for Hazardous Locations
4. CE models for International Electronic Configurations


Call 800-779-4362

LOOKING FOR SCIENTIFIC SURFACE SOLUTIONS

FOR MORE THAN 20 YEARS, OUR HIGHLY DURABLE TRESPA® PANELS HAVE BEEN USED IN CRITICAL LABORATORY APPLICATIONS, WHERE HYGIENE IS A KEY CONSIDERATION. TRESPA® TOPLAB® PLUS® HAS PROVEN RESISTANCE TO BACTERIA, MOISTURE, CHEMICALS AND CLEANING AGENTS.

SO IF YOU ARE LOOKING FOR SCIENTIFIC FURNITURE SOLUTIONS, GET THE FACTS AT TRESPA.COM/TOPLAB

TRESPA NORTH AMERICA LTD.
62 Greene Street (Ground Floor)
New York, NY 10012
United States of America
Tel: +1 800 487-3772
Fax: +1 866 298 3499
ScientificFurniture@Trespa.com

Think Trespa
Total support for construction, reconstruction, expansion and relocation of research facilities.

Proposal of basic concept
Construction and Relocation
Basic and execution design
Maintenance Management

In addition to offering our own products as a leading manufacturer, Yamato Scientific works closely with hundreds of excellent manufacturers worldwide.