

WORCESTER POLYTECHNIC INSTITUTE

CREATING A FIRE PROTECTION DATABASE

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ADVISORS: JAMES CHIARELLI AND PRATAP RAO

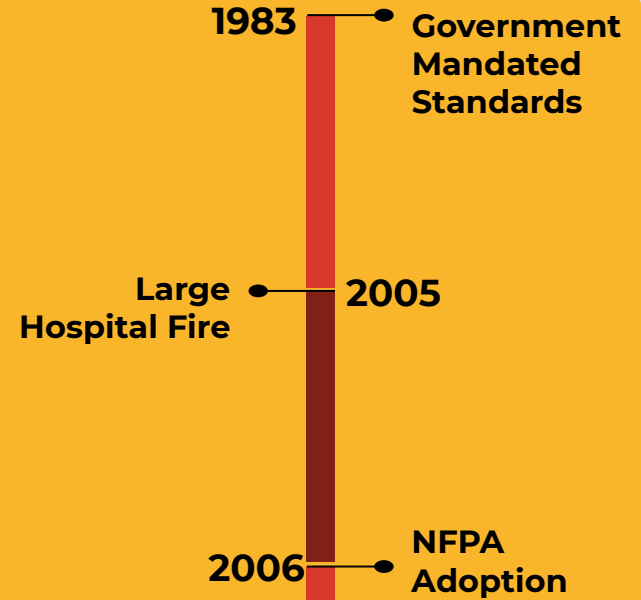
MARCH 15th, 2021



INTRODUCTION & BACKGROUND



FIRES IN COSTA RICA





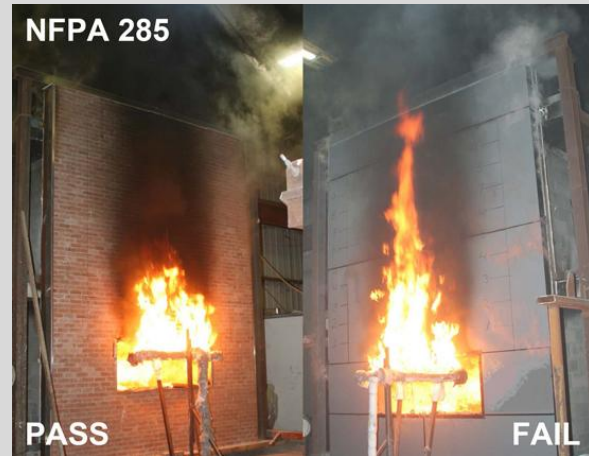
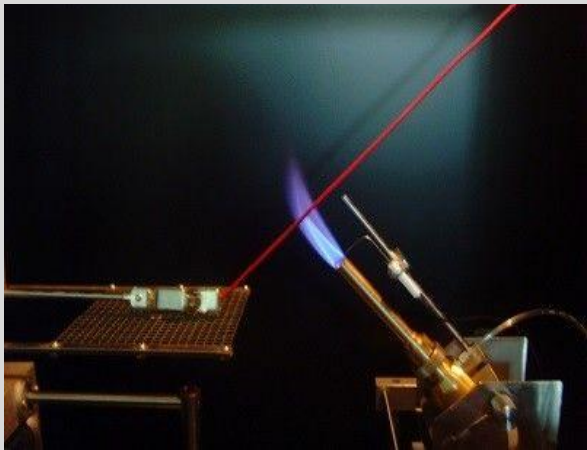
NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 101: Life Safety Code®



UNDERWRITERS LABORATORIES (UL)

HOW DOES FIRE TESTING WORK?





OUR PROJECT

To work in cooperation with the CFIA to create a database of common construction materials that will be accessible to engineers and architects and generate a small-scale cost analysis to determine the feasibility of utilizing UL certified materials.

The image features a central text element surrounded by a decorative border. The border is composed of stylized, flowing flames in shades of orange, yellow, and red, arranged in a circular pattern against a solid black background. The flames have a wispy, ethereal quality, with some areas appearing more intense and others more translucent.

METHODS

OBJECTIVES



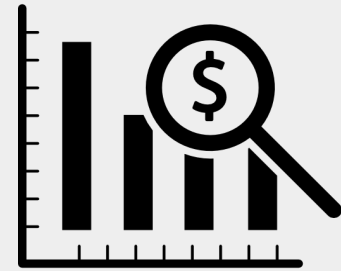
Understand Current
NFPA Code Applications
and UL Certification
Requirements



Collect Technical
Information for
Certified Items



Enter Certified Items
Into a Database



Compare the Cost of
Certified and
Non-Certified Items

Understand Current NFPA Code Application and UL Certification Requirements

- 1st — **NFPA 101 Life Safety Training**
- 2nd — **Independent NFPA Code Research**
- 3rd — **Interview WPI Fire Protection Engineers**

STEP

1

Examine Technical Sheets for Listed Products and Determine if they Comply with Fire Safety Codes

STEP

2

NIBCO

AHEAD OF THE FLOW®

www.nibco.com

Revision 9/16/2011

200 PSI Butterfly Valves

Ductile Iron Body • Extended Neck • Geometric Drive
Molded-in Seat Liner • Lug and Wafer Style

Sizes 2" through 12"

Install between Std. ASME Class 125/150 Flanges Lug Style 200 PSI
bi-directional dead end service rating without a downstream flange required.

CONFORMS TO MSS SP-67 • U.S. Coast Guard "Category A"
• LISTED BY IAPMO R&T FOR COMPLIANCE WITH SECTION
116875 OF THE CALIFORNIA HEALTH AND SAFETY CODE
• VERMONT ACT 193

MATERIAL LIST

PART	SPECIFICATION
1. Stem	Stainless Steel ASTM A582 Type 416
2. Collar Bushing	Brass ASTM B124
3. Stem Seal	EPDM Rubber
4. Body Seal	EPDM Rubber
5. Nameplate	Aluminum
6. Upper Bushing	Copper CDA 122
7. Liner	EPDM Rubber
8. Disc	Alum. Btz. ASTM B148 Alloy 954/955
9. Lower Bushing	Copper CDA 122
10. Body Wafer	Ductile Iron ASTM A536
11. Body Lug	Ductile Iron ASTM A536

DIMENSIONS — WEIGHTS

Size	DIMENSIONS — WEIGHTS											
	A	B	C	D	E	F	G	H	I	J	N	
In. mm.	In.	In.	In.	In.	In.	In.	Flat	Metal	Rubber	Square	Diagonal	
2	50	2.53	4.00	1.25	5.38	2.88	.38	.312	1.688	1.812	3.25	500
2½	65	2.90	4.89	1.25	5.88	3.27	.38	.370	1.812	1.938	3.25	562
3	80	3.15	5.12	1.25	6.12	3.40	.38	.370	1.812	1.938	3.25	562
4	100	4.09	6.12	1.25	6.88	4.00	.38	.403	2.062	2.188	3.25	625
5	125	5.13	7.25	1.25	7.38	4.75	.38	.496	2.188	2.312	3.25	750
6	150	6.13	8.25	1.25	8.00	5.29	.38	.496	2.188	2.312	3.25	750
8	200	8.13	10.41	1.25	9.25	6.50	.50	.560	2.375	2.500	3.25	875
10	250	10.13	12.52	1.25	10.50	8.00	.50	.696	2.688	2.812	4.75	1,125
12	300	12.13	15.00	1.25	12.00	9.25	.50	.748	3.000	3.125	4.75	1,250

Capcrew/Stud Data

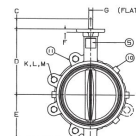
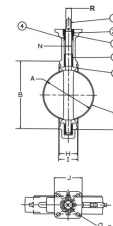
Size	Capcrew/Stud Data				Lug Weight			Wafer Weight	
	Q	P	R	K	L	Wafer Length	Lug Length	M	Wafer Weight
In. mm.	B.C.	Di.	Di.	No.	Di.	In.	In.	B.C.	Lbs. Kg.
2	50	3.25	.437	.437	4	¼-11unc	4½	7	3.2 5.5 2.5
2½	65	3.25	.437	.500	4	¼-11unc	5½	9	4.1 7.5 3.4
3	80	3.25	.437	.500	4	¼-11unc	6	9.5 4.3	8 3.6
4	100	3.25	.437	.562	8	¼-11unc	7½	15 6.8	11 5.0
5	125	3.25	.437	.656	8	¼-10unc	8½	21 9.5	15 6.8
6	150	3.25	.437	.656	8	¼-10unc	9½	24 10.9	18 8.2

Refer to
butterfly
valve
technical
information
for drill

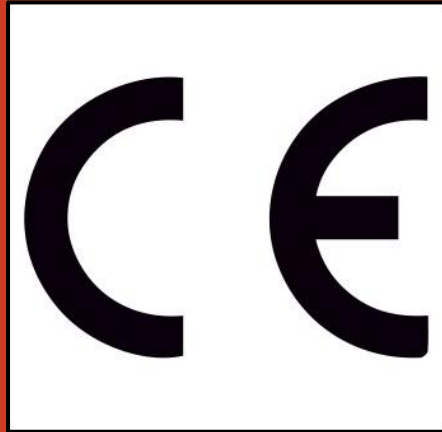
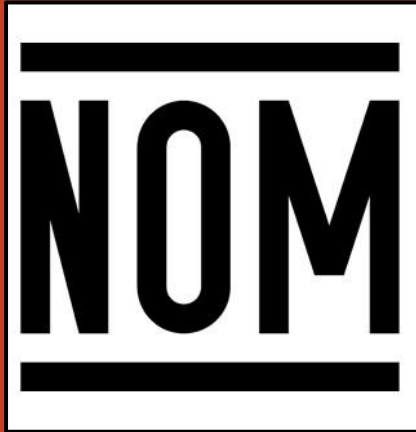


WD 2000
Wafer Style
EPDM Liner
and Aluminum
Bronze Disc

LD 2000
Lug Style
EPDM Liner
and Aluminum
Bronze Disc



**Find Comparable
Non-Compliant
Products**



**STEP
3**

**Compare the Cost of the
Listed and Unlisted Items
and Enter into Database**

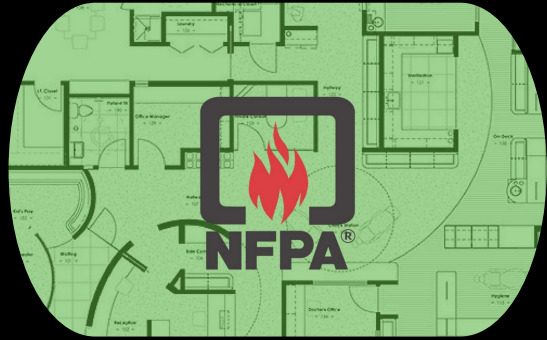


STEP

4

A stylized, abstract graphic of a flame or fire, rendered in shades of orange, yellow, and red, positioned on the left side of the image. The flame appears to be rising and spreading, with a soft, glowing effect. The background is a solid, deep black, which makes the bright colors of the flame stand out prominently.

FINDINGS



**NFPA 101
LIFE
SAFETY
CODE
TRAINING**



**UL
CERTIFICATION
REQUIREMENTS
+ FIRE
TESTING/
INTERVIEWS**

Identifying Products/ Listing in Excel Sheet

UL Product IQ

SEARCH MY SEARCHES MY TAGS DELIA

REFINE RESULTS

Build or filter your results by keyword and/or adding criteria like document type, file number and country name.

Keyword: Smoke Detector

710 Results: Keyword: Smoke Detector

Document Name Company Name Notes UL CCN Description

- URPQ.526366 MGC SYSTEMS CORP Smoke-automatic Fire Detector Accessories
- URPQ.536680 Avenger Systems LLC Smoke-automatic Fire Detector Accessories
- URPQ.536861 BRISTOL FIRE ENGINEERING L L C Smoke-automatic Fire Detector Accessories
- URPQ.536905 Tyco Fire & Security GmbH Smoke-automatic Fire Detector Accessories
- URPQ.54013 GEMINI SCIENTIFIC CORP Smoke-automatic Fire Detector Accessories
- URPQ.54058 NDMH BOSAI LTD Smoke-automatic Fire Detector Accessories
- URPQ.54994 Bosh Security Systems, Inc Smoke-automatic Fire Detector Accessories
- URPQ.56081 SIEMENS INDUSTRY INC Smoke-automatic Fire Detector Accessories
- URPQ.57202 HORNG LH INDUSTRIAL CO LTD Smoke-automatic Fire Detector Accessories
- URPQ7.52438 Kidde-Fenwal Inc Smoke-automatic Fire Detector Accessories Certified for Canada
- URPQ7.52522 System Sensor Unincorporated, Div of Honeywell International Inc Smoke-automatic Fire Detector Accessories Certified for Canada

Category	Material Name	Model Number	UL File Number	UL CCN	Company Information	Certification Type
	Compression Type Coupling -Steel	661SRT 662SRT 663SRT 664SRT 665SRT 666SRT 667SRT 668SRT 669SRT 670SRT	E18474	FJMX	TOPAZ ELECTRIC CORP, 925 WAVERLY AVE HOLTSVILLE, NY 11742-1109 United States	UL
	EMT Connectors and Couplings, Compression Type - Raintight - Steel	651SRT 652SRT 653SRT 654SRT 655SRT 656SRT 657SRT 658SRT 659SRT 660SRT	E18475	FJMX	TOPAZ ELECTRIC CORP, 925 WAVERLY AVE HOLTSVILLE, NY 11742-1109 United States	UL
	EMT Connectors and Couplings, Compression Type with Insulated Throat- Raintight - Steel	651SIRT 652SIRT 653SIRT 654SIRT 655SIRT 656SIRT 657SIRT 658SIRT 659SIRT 660SIRT	E18476	FJMX	TOPAZ ELECTRIC CORP, 925 WAVERLY AVE HOLTSVILLE, NY 11742-1109 United States	UL
	EMT Connectors and Couplings, Compression Type Raintight Coupling - Steel	661SRT 662SRT 663SRT 664SRT 665SRT 666SRT 667SRT 668SRT 669SRT 670SRT	E18477	FJMX	TOPAZ ELECTRIC CORP, 925 WAVERLY AVE HOLTSVILLE, NY 11742-1109 United States	UL
	STEEL EMT CONNECTORS COMPRESSION TYPE & RAIN TIGHT	OF7601 OF7602 OF7603 OF7604 OF7605 OF7606 OF7607 OF7608 OF7609 OF7610 OF7611-W OF7602-W OF7603-W OF7604-W OF7605-W OF7606-W OF7607-W OF7608-W OF7609-W OF7610-W	E310660	FJMX	Orbit Industries Inc, DBA UMI, 2100 S FIGUEROA ST, LOS ANGELES, CA 90007 United States	UL
	STEEL EMT CONNECTORS COMPRESSION TYPE & RAIN TIGHT INSULATED	OF7601-S OF7602-S OF7603-S OF7604-S OF7605-S OF7606-S OF7607-S OF7608-S OF7609-S OF7610-S OF7601-SW OF7602-SW OF7603-SW OF7604-SW OF7605-SW OF7606-SW OF7607-SW OF7608-SW OF7609-SW OF7610-SW	E310660	FJMX	Orbit Industries Inc, DBA UMI, 2100 S FIGUEROA ST, LOS ANGELES, CA 90007 United States	UL
	STEEL EMT COUPLINGS COMPRESSION TYPE & RAIN TIGHT	OF7611 OF7612 OF7613 OF7614 OF7615 OF7616 OF7617 OF7618 OF7619 OF7620 OF7611-W OF7612-W OF7613-W OF7614-W OF7615-W OF7616-W OF7617-W OF7618-W OF7619-W OF7620-W	E310660	FJMX	Orbit Industries Inc, DBA UMI, 2100 S FIGUEROA ST, LOS ANGELES, CA 90007 United States	UL
	Concrete Pull Elbows	ECS-50, ECS-75	E310660	FJMX	Orbit Industries Inc, DBA UMI, 2100 S FIGUEROA ST, LOS ANGELES, CA 90007 United States	UL
	Connectors	OF601-S, OF601-SW, OF602-S, OF602-SW, OF603-S, OF603-SW, OF604-S, OF604-SW, OF605-S, OF605-SW, OF606-S, OF606-SW, OF607-S, OF607-SW, OF608-S, OF608-SW, OF609-S, OF609-SW, OF610-S, OF610-SW, OF701-S, OF702-S, OF703-S, OF704-S, OF705-S, OF706-S, OF707-S, OF708-S, OF709-S, OF710-S	E310660	FJMX	Orbit Industries Inc, DBA UMI, 2100 S FIGUEROA ST, LOS ANGELES, CA 90007 United States	UL
	Connectors, Straight	OCC-50, OCC-75, OF601, OF601-W, OF602, OF602-W, OF603, OF603-W, OF604, OF604-W, OF605, OF605-W, OF606, OF606-W, OF607, OF607-W, OF608, OF608-W, OF609, OF609-W, OF610, OF610-W, OF701, OF702, OF703, OF704, OF705, OF706, OF707, OF708, OF709, OF710	E310660	FJMX	Orbit Industries Inc, DBA UMI, 2100 S FIGUEROA ST, LOS ANGELES, CA 90007 United States	UL
	Connectors: Straight	OCS-50, OCS-75	E310660	FJMX	Orbit Industries Inc, DBA UMI, 2100 S FIGUEROA ST, LOS ANGELES, CA 90007 United States	UL
	Couplings	OF611, OF611-W, OF612, OF612-W, OF613, OF613-W, OF614, OF614-W, OF615, OF615-W, OF616, OF616-W, OF617, OF617-W, OF618, OF618-W, OF619, OF619-W, OF620, OF620-W, OF711, OF712, OF713, OF714, OF715, OF716, OF717, OF718, OF719, OF720	E310660	FJMX	Orbit Industries Inc, DBA UMI, 2100 S FIGUEROA ST, LOS ANGELES, CA 90007 United States	UL
	Rain Tight Compression Connectors	OF7601-W, OF7602-W, OF7603-W, OF7604-W, OF7605-W, OF7606-W, OF7607-W, OF7608-W, OF7609-W, OF7610-W	E310660	FJMX	Orbit Industries Inc, DBA UMI, 2100 S FIGUEROA ST, LOS ANGELES, CA 90007 United States	UL
	Rain Tight Compression Connectors with Insulator	OF7601-SW, OF7602-SW, OF7603-SW, OF7604-SW, OF7605-SW, OF7606-SW, OF7607-SW, OF7608-SW, OF7609-SW, OF7610-SW	E310660	FJMX	Orbit Industries Inc, DBA UMI, 2100 S FIGUEROA ST, LOS ANGELES, CA 90007 United States	UL
	plings	OF7611-W, OF7612-W, OF7613-W, OF7614-W, OF7615-W, OF7616-W, OF7617-W, OF7618-W, OF7619-W, OF7620-W	E310660	FJMX	Orbit Industries Inc, DBA UMI, 2100 S FIGUEROA ST, LOS ANGELES, CA 90007 United States	UL

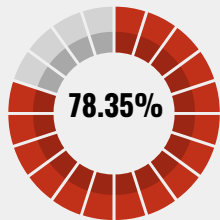
COST ANALYSIS

Category	Material Name	Compliant Price	Non-Compliant Price	% Difference	Price Difference	Average % Difference	Average Price Difference	Category	Average	55.40%
Valves and Accessories						78%	\$ 348.99	Valves and Accessories	78.35%	
	Waterflow Detector	\$ 184.34	\$ 150.00	19%	\$ 34.34			Pumps	28.75%	
	Butterfly Valves, Lugged Wafer	\$ 762.40	\$ 50.00	93%	\$ 712.40			Piping	43.26%	
	Model G Swing Check Valves	\$ 600.00	\$ 57.00	91%	\$ 543.00			Extinguishers	81.28%	
	Check Valve Swing	\$ 345.24	\$ 25.00	93%	\$ 320.24			Fire Suppression	25.12%	
	Test and Drain Valve	\$ 139.99	\$ 5.00	96%	\$ 134.99			Medical Gases	47.36%	
Pumps						41%	\$ 200.00	Lamps	51.92%	
	Centrifugal Fire Pumps, Vertical Turbine	\$ 800.00	\$ 500.00	38%	\$ 300.00			Conduits	74.44%	
	Centrifugal Fire Pumps, Horizontal Split Case	\$ 500.00	\$ 400.00	20%	\$ 100.00			Cables	27.31%	
Piping						43%	\$ 54.87	Devices	74.27%	
	Grooved and Plain End Fittings	\$ 137.96	\$ 78.00	43%	\$ 59.96			Fire Detection	81.75%	
	Rigid Coupling	\$ 202.98	\$ 77.34	62%	\$ 125.64			Transformers	51.00%	
	Flexible Coupling	\$ 33.98	\$ 20.00	41%	\$ 13.98					
	Grooved Flange	\$ 74.88	\$ 55.00	27%	\$ 19.88					
Extinguishers						79%	\$ 152.63	Category	Average	\$171.08
	Water & Foam	\$ 256.00	\$ 25.07	90%	\$ 230.93			Valves and Accessories	\$348.99	
	Carbon Dioxide (CO2)	\$ 206.00	\$ 37.00	82%	\$ 169.00			Pumps	\$200.00	
	ABC Dry Chemical	\$ 80.96	\$ 23.00	72%	\$ 57.96			Piping	\$54.87	
Fire Suppression						37%	\$ 60.60	Extinguishers	\$152.63	
	Cabinets	\$ 248.46	\$ 66.79	73%	\$ 181.67			Fire Suppression	\$60.60	
	Sprinklers, Automatic and Open (AG Fire Sprinkler SL)	\$ 5.96	\$ 6.00	-1%	(0.04)			Medical Gases	\$955.00	
	Sprinklers, Automatic and Open (Reliable Automatic Sprinkler Co., Inc.)	\$ 6.18	\$ 6.00	3%	\$ 0.18			Lamps	\$23.52	
Medical Gases						50%	\$ 955.00	Conduits	\$1.21	
	Multiple Alarm Valve Combo Unit	\$ 2,645.00	\$ 750.00	72%	\$ 1,895.00			Cables	\$31.46	
	Chematron Wall Outlet	\$ 65.00	\$ 50.00	23%	\$ 15.00			Devices	\$11.40	
Lamps						52%	\$ 23.52	Fire Detection	\$42.16	
	LED Surface Mounted Luminaire	\$ 39.29	\$ 11.45	71%	\$ 27.84					
	LED Recessed Luminaire	\$ 58.18	\$ 38.99	33%	\$ 19.19					
Conduits						67%	\$ 1.21			
	EMT Connectors and Couplings, Compression Type									
	Coupling - Steel	\$ 0.46	\$ 0.20	57%	\$ 0.26					
	Connectors	\$ 0.84	\$ 0.43	49%	\$ 0.41					
	4" Drawn Square Boxes	\$ 1.11	\$ 0.09	92%	\$ 1.02					
	Conduit Bodies for Electrical Metallic Tubing	\$ 4.62	\$ 2.75	40%	\$ 1.87					
	Octagon Boxes	\$ 2.98	\$ 0.09	97%	\$ 2.89					
	Outlet Boxes	\$ 1.27	\$ 0.09	93%	\$ 1.18					
	Rectangle Boxes	\$ 0.92	\$ 0.06	93%	\$ 0.86					
Cables						56%	\$ 31.46			
	Thermoplastic-Insulated Wire	\$ 690.00	\$ 685.80	1%	\$ 4.20					
	Metal-Clad Cable	\$ 108.71	\$ 50.00	54%	\$ 58.71					
Devices						71%	\$ 11.40			
	Receptacles: Hospital Grade	\$ 27.50	\$ 3.45	87%	\$ 24.05					
	Receptacles: Tamper Resistant	\$ 3.47	\$ 0.65	81%	\$ 2.82					
	Receptacles: General Grade, Tamper Resistant, Duplex Receptacles	\$ 7.89	\$ 0.81	90%	\$ 7.08					
	Receptacles/ Surge Protective Devices/ Plug Tail, Type 3 Application, Hospital Grade, Tamper Resistant	\$ 30.82	\$ 0.90	97%	\$ 29.92					
	Nonmetallic Cover Plates with Receptacles	\$ 0.40	\$ 0.40	0%	\$ -					
	Receptacles	\$ 5.03	\$ 0.50	90%	\$ 4.53					
Fire Detection						82%	\$ 42.16			
	Smoke / Heat/ Carbon Monoxide Detector	\$ 54.00	\$ 10.00	81%	\$ 44.00					
	Indoor Horn Strobes	\$ 50.49	\$ 7.90	84%	\$ 42.59					
	Indoor Strobes	\$ 35.00	\$ 3.70	89%	\$ 31.30					
	Dual Action Addressable Manual Pull Station	\$ 70.75	\$ 20.00	72%	\$ 50.75					
Transformers						51%	\$ 1,020.00			
	Liquid Filled Distribution Transformer	\$ 2,000.00	\$ 980.00	51%	\$ 1,020.00					

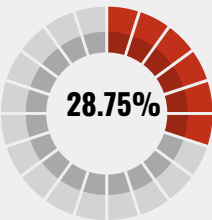
**ON AVERAGE,
CERTIFIED PRODUCTS
ARE...**



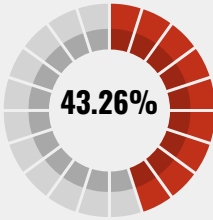
**MORE EXPENSIVE THAN
NON-CERTIFIED
PRODUCTS.**



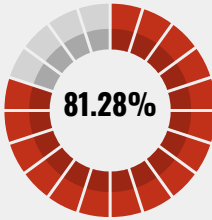
Valves & Accessories



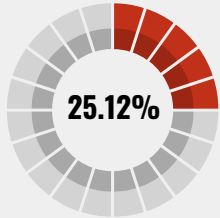
Pumps



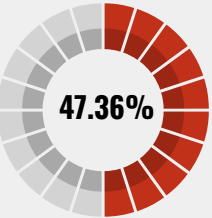
Piping



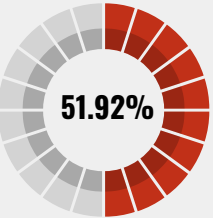
Extinguishers



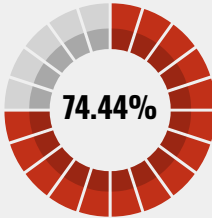
Fire Suppression



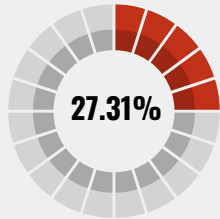
Medical Gases



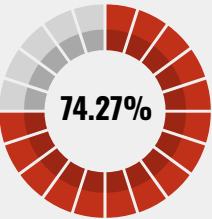
Lamps



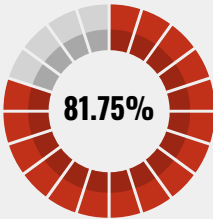
Conduits



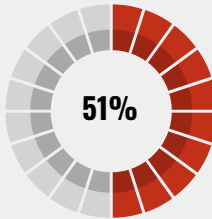
Cables



Devices



Fire Detection



Transformers

CONCLUSIONS AND RECOMMENDATIONS



WE HOPE OUR PROJECT...

**Encourages
Use of
Compliant
Materials**



**Promotes
Life Safety**



**Emphasizes
the UL
Standard**



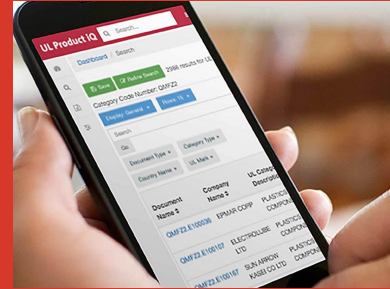
**Provides a
Foundation
for
Prevention
of Fires**

RECOMMENDATIONS

NFPA COURSES



UL iQ AWARENESS



DEVELOP NEW DATABASES



UNIVERSAL STANDARD



THANK YOU



**JAMES
CHIARELLI,
ADVISOR**



**HERNAN
HERNANDEZ,
SPONSOR**



**PRATAP
RAO,
ADVISOR**



**MARIO
AMADOR,
SPONSOR**

ADDITIONAL THANKS TO PROJECT ORGANIZER MELISSA BELZ, INTERVIEWEE ALBERT SIMEONI, WORCESTER POLYTECHNIC INSTITUTE, & CFIA

FIGURE SOURCES

NFPA Icon: <https://brandslogos.com/n/nfpa-international-logo/>

Document Icon:

<https://www.freeiconspng.com/images/document-icon>

Excel Icon:

<https://davidbaptistechirot.blogspot.com/2018/03/excel-file-icon-png.html>

Cost Analysis Icon:

<https://www.pngrepo.com/svg/226792/bars-chart-statistics>

EU Certification Icon:

<https://www.seton.com/ce-mark-labels-cs136.html>

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