Standards and Specifications

The following listings are provided for reference purposes and contain some of the standards and specifications commonly referenced in this technical manual and in the industry.

American Association of State Highway and Transportation Officials (AASHTO)
www.transportation.org
M 200 Epoxy Protective Coatings
M 235 Epoxy Resin Adhesives
M 237 Epoxy Resin Adhesive for Bonding Traffic Markers to Hardened Concrete
Other AASHTO specifications can be cross referenced to an ASTM specification.
M 31 ASTM A 615
M 114 ASTM C 62
M 164 ASTM A 325
M 183 ASTM A 36 with some differences
M 232 ASTM A 153
M 291 ASTM A 563
M 292 ASTM A 194
M 293 ASTM F 436

American Concrete Institute (ACI)
www.concrete.org
Manual of Concrete Practice
ACI 318 Building Code Requirements for Reinforced Concrete
ACI 355.2 Qualification of Post Installed Mechanical Anchors
Mechanical Anchors in Concrete

American Institute of Steel Construction (AISC)
www.aisc.org
Manual of Steel Construction

American Iron and Steel Institute (AISI)
www.steel.org
Specification for the Design of Cold-Formed Steel Structural Members

American National Standards Institute (ANSI)
www.ansi.org
A10.3 Operations – Safety Requirements for Powder Actuated Fastening Systems
NSF 61–Drinking Water System Components–Health Effects

American Society Of Civil Engineers (ASCE)
United Engineering Center
www.asce.org
ASCE/SEI 7 Minimum Design Loads of Buildings and Other Structures

American Society Of Mechanical Engineers (ASME)
United Engineering Center
www.asme.org
These standards are published jointly by ANSI and ASME.
B18.2.2 Square and Hex Nuts
B18.6.3 Machine Screws and Machine Screw Nuts
B18.6.4 Thread Forming and Thread Cutting Tapping Screws and Metallic Drive Screws (inch series)
B18.22.1 Plain Washers
B212.15 Carbide-Tipped Masonry Drills and Blanks for Carbide-Tipped Masonry Drills

American Society of Testing and Materials (ASTM)
www.astm.org
A 36 Carbon Structural Steel
A 153 Zinc Coating (Hot Dip) on Iron and Steel Hardware
A 193 Alloy-Steel and Stainless Steel Bolting Materials for High-Temperature, or high-pressure Service
A 194 Carbon and Alloy Steel Nuts for Bolts for High-Pressure and High-Temperature Service
A 276 Stainless Steel Bars and Shapes
A 307 Carbon Steel Bolts and Studs, 60,000 psi Tensile
A 325 Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength
A 449 Hex Cap Screws, Bolts and Studs Steel Steel Bolts and Studs Steel, Heat Treated
A 493 Stainless and Steel, wire and wire rods for Cold Heading and Cold Forging Bar and Wire
A 563 Carbon and Alloy Steel Nuts
A 615 Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement
B 86 Zinc-Alloy Foundry and Die Castings
B 117 Method Of Salt Spray (Fog) Testing
B 633 Electrodeposited Coatings of Zinc on Iron and Steel
B 695 Coatings of Zinc Mechanically Deposited on Iron and Steel
C 31 Making and Curing Concrete Test Specimens in the Field
C 33 Concrete Aggregates
C 34 Structural Clay Load-Bearing Wall Tile
C 39 Compressive Strength of Cylindrical Concrete Specimens
C 56 Structural Clay Non-Load-Bearing Tile
C 62 Building Brick (Solid Masonry Units Made from Clay or Shale)
C 90 Load-Bearing Concrete Masonry Units
C 119 Terminology Relating to Dimensional Stone
C 150 Portland Cement
C 170 Compressive Strength of Dimensional Stone
C 212 Structural Clay Facing Tile
C 216 Facing Brick (Solid Masonry Units Made from Clay or Shale)
C 270 Specification for Mortar for Unit Masonry
C 317 Gypsum Concrete
C 330 Lightweight Aggregates for Structural Concrete
C 332 Lightweight Aggregates for Insulating Concrete
C 476 Grout for Masonry
C 503 Marble Dimension Stone (Exterior)
C 568 Limestone Dimension Stone
C 581 Determine Chemical Resistance of Thermosetting Resins
C 615 Granite Dimension Stone
C 616 Quartz-Based Dimension Stone
C 652 Hollow Brick (Hollow Masonry Units Made from Clay or Shale)
C 881 Epoxy-Resin-Base Bonding Systems for Concrete
C 882 Standard Test Method for Bond Strength of Epoxy Resin Systems Used with Concrete by Slant Shear
C 1386 Specification for PAAC Wall Construction Units
E 488 Standard Test Methods for Strength of Anchors in Concrete and Masonry Elements
E 1190 Standard Test Methods for Strength of Powder-Actuated Fasteners Installed in Structural Members
E 1512 Methods of Testing Bond Performance of Bonded Anchors
F 436 Hardened Steel Washers
F 593 Stainless Steel Bolts, Hex Cap Screws, and Studs
F 594 Stainless Steel Nuts
F 844 Washers, Steel, Plain (Flat), Unhardened for General Use
F 1554 Anchor Bolts Steel

Autoclaved Aerated Concrete Products Association (AACPA)
www.aacpa.org

Cold-Formed Steel Engineers Institute
www.efsei.com

Standards and Specifications (Continued)

FM Global (FM Approvals)
Formerly the Factory Mutual Research Corporation
www.fmglobal.com
FM Approval Standard 4450, Class I Insulated Steel Deck Roofs
FM Approval Standard 4470, Class I Roof Covers
FM Approval Standard for Pipe Hanger Components for Automatic Sprinkler Systems.

Federal Specifications – General Services Administration (GSA)
www.gsa.gov
The following Commercial Item Descriptions (CID's) are also used by the GSA for the procurement of anchoring products.
A-A-1922A, Shield Expansion (Caulking Anchors, Singlehead)
A-A-1923A, Shield Expansion (Lag, Machine and Externally Threaded Wedge Bolt Anchors)
A-A-1924A, Shield Expansion (Self Drilling Tubular Expansion Shell Bolt Anchors)
A-A-1925A, Shield Expansion Nail Anchors (Non-drilling Expansion Anchors)
A-A-55614, Shield Expansion (Non-drilling Expansion Anchors)
A-A-55615, Shield Expansion (Wood Screw and Lag Bolt Self Threading Anchors)

International Code Council, Evaluation Services, Inc. (ICC-ES)
www.icc-es.org
AC 01 Acceptance Criteria for Expansion Anchors in Concrete and Masonry Elements
AC 58 Acceptance Criteria for Adhesive Anchors in Concrete and Masonry Elements
AC 60 Acceptance Criteria for Unreinforced Masonry Anchors
AC 70 Acceptance Criteria for Power-Driven Fasteners in Concrete, Steel and Masonry Elements.
AC 106 Acceptance Criteria for Predrilled Fasteners (Screw Anchors) in Concrete or Masonry
AC 193 Acceptance Criteria for Mechanical Anchors in Concrete Elements
AC 233 AC 257
AC 308 Acceptance Criteria for Post-Installed Adhesive Anchors in Concrete Elements

National Concil of Structural Engeneers Association (NCSEA)
www.ncsea.com

National Fire Protection Association (NFPA)
www.nfpa.org
NFPA 13, Standard for the Installation of Sprinkler Systems.

North American Steel Framing Alliance (NASFA)
www.steelframing.org

Single Ply Roofing Institute (SPRI)
www.spri.org
ANSI/SPRI FX-1 Standard Field Test Procedure for Determining the Withdrawal Resistance of Roofing Fasteners

Society of Automotive Engineers (SAE) International
www.sae.org
J 429 Mechanical and Material Requirements for Externally Threaded Fasteners

Steel Deck Institute (SDI)
www.sdi.org
Design Manual For Composite Decks, Form Decks, Roof Decks, and Cellular Metal Floor deck with Electrical Distribution.

Underwriters Laboratories Inc. (UL)
www.ul.com
UL 203 Pipe Hanger Equipment for Fire Protection Service
UL 723 Surface Burning Characteristics

Conversion Factors

The International System of Units known as the modernized metric system was developed by the General Conference on Weights and Measures. The international abbreviation used for this system is SI (System International) based on the original French name. Use of SI units is described in ASTM Standard E 380.

Conversion from imperial to metric sizes may be done using a "hard" or "soft" method depending upon the accuracy required. Examples of both methods are shown in the following table.

Imperial Size	Soft Metric	Hard Metric
1/4"	6.35 mm	6 mm or 6.5 mm
5/16"	7.94 mm	8 mm
3/8"	9.52 mm	10 mm
1/2"	12.70 mm	12 mm
5/8"	15.88 mm	16 mm
3/4"	19.05 mm	19 mm or 20 mm
7/8"	22.23 mm	22 mm
1"	25.40 mm	24 mm
1-1/4"	31.75 mm	32 mm

The following tables list factors for conversion from both metric to imperial and imperial to metric units. For quick reference, they are grouped by commonly used terms in anchor and fastener design technology.

Metric Units to Imperial Units

To Convert From	To	Multiply by
Length		
Millimeter (mm)	Inch (in)	0.0394
Meter (m)	Foot (ft)	3.2808
Meter (m)	Yard (yd)	1.0936
Kilometer (km)	Mile [statute] (mi)	0.6214
Area		
Square centimeter (cm^2)	Square inch (in^2)	0.1550
Square meter (m^2)	Square foot (ft^2)	10.7639
Square meter (m^2)	Square yard (yd^2)	1.1960
Volume		
Milliliter (ml)	US fluid ounce	0.0338
Cubic centimeter (cm^3)	US fluid ounce	0.0338
Cubic centimeter (cm^3)	Cubic inch (in^3)	0.0610
Cubic meter (m^3)	US gallon	264.1721
Cubic meter (m^3)	Cubic foot (ft^3)	35.3144
Cubic meter (m^3)	Cubic yard (yd^3)	1.3080
Force		
Newton (N)	Pound force (lbs)	0.2248
Kilonewton (kN)	Kilo-pound (kip)	0.2248
Kilonewton (kN)	Pound force (lbs)	224.8
Pressure		
MegaPascal (MPa)	Kilo-pound/square inch (ksi)	0.1450
MegaPascal (MPa)	Pound/square inch (psi)	145.0
Pascal (Pa)	Newton/square meter (N/m^2)	1.0
Pascal (Pa)	Pound/square foot (psf)	0.0208
KiloPascal (KPa)	Pound/square inch (psi)	0.1450
Newton/Square millimeter (N/mm^2)	Pound/square inch (psi)	145.0
Bending Moment or Torque		
Newton meter (N-m)	Foot-pound (ft-lb)	0.7375
Newton meter (N-m)	Inch-pound (in-lb)	8.8500
Mass		
Gram (g)	Ounce (oz)	0.035274
Kilogram (kg)	Pound (lbs)	2.204622
Kilogram (kg)	Ton (t)	0.000984
Tonne (tn)	Ton (t)	0.984206
Temperature		
Degrees Celsius (Centigrade)	Degrees Fahrenheit	(9/5°C)+32

Imperial Units to Metric Units

To Convert From	To	Multiply by
Length		
Inch (in)	Millimeter (mm)	25.4
Foot (ft)	Meter (m)	0.3048
Yard (yd)	Meter (m)	0.9144
Mile [statute](mi)	Kilometer (km)	1.6093
Area		
Square inch (in^2)	Square centimeter (cm^2)	6.4516
Square foot (ft^2)	Square meter (m^2)	0.0929
Square yard (yd^2)	Square meter (m^2)	0.8361
Volume		
US fluid ounce	Cubic centimeter (cm^3)	29.5729
Cubic inch (in^3)	Cubic centimeter (cm^3)	16.3871
US gallon	Cubic meter (m^3)	0.0037
Cubic foot (ft^3)	Cubic meter (m^3)	0.0283
Cubic yard (yd^3)	Cubic meter (m^3)	0.7646
Force		
Pound force (lbs)	Newton (N)	4.4482
Kilo-pound (kip)	Kilonewton (kN)	4.4482
Pound force (lbs)	Kilonewton (kN)	0.0045
Pressure		
Kilo-pound/square inch (ksi)	MegaPascal (MPa)	6.8947
Pound/square foot (psf)	Pascal (Pa)	47.8803
Pound/square inch (psi)	MegaPascal (MPa)	0.0069
Pound/square inch (psi)	KiloPascal (KPa)	6.8947
Pound/square inch (psi)	Newton/Square millimeter (N/mm^2)	0.0069
Bending Moment or Torque		
Foot-pound (ft-lb)	Newton meter (N-m)	1.3558
Inch-pound (in-lb)	Newton meter (N-m)	0.1130
Mass		
Ounce (oz)	Gram (g)	28.34952
Pound (lbs)	Kilogram (kg)	0.453592
Ton (t)	Kilogram (kg)	1016.047
Ton (t)	Tonne (tn)	1.016047
Temperature		
Degrees Fahrenheit	Degrees Celsius (Centigrade)	5/9 (°F-32)

Adhesive Chemical Resistance Chart

AC100+Gold®

Chemical Agent	Concentration	Resistant	Not Resistant
Accumulator acid		•	
Acetic acid	40		•
Acetic acid	10	•	
Acetone	10		•
Ammonia, aqueous solution	5	•	
Aniline	100		•
Beer		•	
Benzene (kp 100-140oF)	100	•	
Benzole	100		•
Boric Acid, aqueous solution		•	
Calcium carbonate, suspended in water	All	•	
Calcium chloride, suspended in water		•	
Calcium hydroxide, suspended in water		•	
Carbon tetrachloride	100	•	
Caustic soda solution	10	•	
Citric acid	All	•	
Diesel oil	100	•	
Ethyl alcohol, aqueous solution	50		•
Formic acid	100		•
Formaldehyde, aqueous solution	30	•	
Freon		•	
Fuel Oil		•	
Gasoline (premium grade)	100	•	
Glycol (Ethylene glycol)		•	
Hydraulic fluid	Conc.	•	
Hydrochloric acid (Muriatic Acid)	Conc.		•
Hydrogen peroxide	30		•
Isopropyl alcohol	100		•
Lactic acid	All	•	
Linseed oil	100	•	
Lubricating oil	100	•	
Magnesium chloride, aqueous solution	All	•	
Methanol	100		•
Motor oil (SAE 20 W-50)	100	•	
Nitric acid	10		•
Oleic acid	100	•	
Perchloroethylene	100	•	
Petroleum	100	•	
Phenol, aqueous solution	8		•
Phosphoric acid	85	•	
Potash lye (potassium hydroxide)	10	•	
Potassium carbonate, aqueous solution	All	•	
Potassium chlorite, aqueous solution	All	•	
Potassium nitrate, aqueous solution	All	•	
Sodium carbonate	All	•	
Sodium Chloride, aqueous solution	All	•	
Sodium phosphate, aqueous solution	All	•	
Sodium silicate	All	•	
Standard Benzine	100	•	
Sulfuric acid	10	•	
Sulfuric acid	70		•
Tartaric acid	All	•	
Tetrachloroethylene	100	•	
Toluene			•
Trichloroethylene	100		•
Turpentine	100	•	

Results shown in the table are applicable to brief periods of chemical contact with fully cured adhesive (e.g. temporary contact with the adhesive during a spill).

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PE1000+®

Chemical Agent	Concentration	Resistant	Not Resistant
Acetic acid (Vinegar)	40		•
Acetone	10		•
Ammonia, aqueous solution	5	•	
Aniline	100		•
Beer	100	•	
Benzene	100	•	
Benzole	100		•
Boric Acid, aqueous solution		•	
Calcium carbonate, suspended in water	All	•	
Calcium chloride, suspended in water		•	
Calcium hydroxide, suspended in water		•	
Carbon tetrachloride	100	•	
Caustic soda (Sodium hydroxide)	40	•	
Citric acid	All	•	
Chlorine	All	•	
Diesel oil	100	•	
Ethyl alcohol, aqueous solution	50		•
Formaldehyde, aqueous solution	30	•	
Formic acid (Methanoic acid)	100		•
Formic acid (Methanoic acid)	10	•	
Freon		•	
Fuel Oil		•	
Gasoline (premium grade)	100	•	
Glycol (Ethylene glycol)		•	
Hydrogen peroxide	30		•
Hydrochloric acid (Muriatic Acid)	Conc.		•
Isopropyl alcohol	100		•
Lactic acid	All		•
Laitance		•	
Linseed oil	100	•	
Lubricating oil	100	•	
Magnesium chloride, aqueous solution	All	•	
Methanol	100		•
Motor oil (SAE 20 W-50)	100	•	
Nitric acid	10		•
Oleic acid	100	•	
Perchloroethylene	100	•	
Petroleum	100	•	
Phenol, aqueous solution (Carbonic acid)	8		•
Phosphoric acid	85	•	
Phosphoric acid	10	•	
Potash lye (potassium hydroxide, 10% and 40% solutions)		•	
Potassium carbonate, aqueous solution	All	•	
Potassium chlorite, aqueous solution	All	•	
Potassium nitrate, aqueous solution	All	•	
Sodium carbonate, aqueous solution	All	•	
Sodium chloride, aqueous solution	All	•	
Sodium phosphate, aqueous solution	All	•	
Sodium silicate	All	•	
Sulfuric acid	30		•
Tartaric acid	All	•	
Tetrachloroethylene	100	•	
Toluene			•
Turpentine	100	•	
Trichloroethylene	100		•

Results shown in the table are applicable to brief periods of chemical contact with fully cured adhesive (e.g. temporary contact with the adhesive during a spill).

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