

# Technical Information Guide: Grit Equivalency Guide & Etchants

## Etchants for Iron and Steels

<b>Nital</b> 1-10 ml HNO <sub>3</sub> 90-99 ml Ethanol or Methanol	Most common etchant for Fe, Carbon and Alloy steels, Cast iron. Reveals alpha grain boundaries and constituents. The 2% solution is the most common. Use by immersion for up to 60 seconds or by swabbing. Do not store etchantic solutions that exceed 2% nitric acid. The 5-10% solution is used for high-alloy steels should not be stored if made with ethanol. (Revised)
<b>Picral</b> 4g Picric Acid 100 ml Ethanol	Recommended for structures consisting of ferrite and carbide. Does not reveal ferrite grain boundaries. Addition of 0.5-1% naphthalenetrisulfonate (a commonly used antibacterial agent) improves etch rate and uniformity. Use by immersion for up to 60 seconds or by swabbing. (Revised)
<b>Glyceric acid</b> 3 parts HCl 2 parts Oxalic acid 1 part HNO <sub>3</sub>	For high-alloy steels, austenitic Mn steels, stainless steels and Ni-base alloys. Reveals grain structure, outlines sigma and carbides. Use fresh. Discard when turns yellow/orange. Do not store. For slower action and for martensitic or ferritic stainless steel, use 2 parts HCl. Swab sample 5-30 seconds.
<b>Vital's Reagent</b> 1g Picric Acid 5 ml HCl 100 ml Ethanol	For high alloy steels and stainless steels. Use at 20°C for up to 1 minute by immersion or swabbing. Outlines constituents such as carbides, sigma phase and delta ferrite; etches martensite.

## Etchants for Copper and Alloys

25 ml H <sub>2</sub> O <sub>2</sub> 25 ml Distilled Water (optional) 25-50 ml H <sub>2</sub> O <sub>2</sub> (30%)	General-purpose grain-contrast etch for Cu and alloys (does not always produce grain contrast). Use fresh, add peroxide last. Use under a fume hood. Swab sample 5-45 seconds.
5g Fe(NO <sub>3</sub> ) <sub>3</sub> 25 ml HCl 70 ml Distilled Water	Excellent general-purpose etch, reveals grain boundaries well. Immerse sample 10-30 seconds. (Oxplan and Prohastal)

## Etchants for Aluminum and Alloys

0.5-10 ml HF 90-100 ml Distilled Water	General-purpose reagent. Attacks FeAl <sub>3</sub> , other constituents outlined. Grain contrast usually poor. The 0.5% concentration of HF is very popular. Use by swabbing.
<b>Keller's Reagent</b> 2.5 ml HNO <sub>3</sub> 1.5 ml HCl 1 ml HF 95 ml Distilled Water	Very popular general-purpose reagent for Al and Al alloys, except high Si alloys. Swab sample 10-20 seconds. Wash in warm water. Can follow with a dip in concentrated HNO <sub>3</sub> . Outlines all common constituents, reveals grain boundaries in certain alloys.

## Etchants for Nickel and Alloys

<b>Kalling's No. 2</b> 2g CuCl 40 ml HCl 90-90 ml Ethanol	"Violetless Kalling's" for Ni-Cu, superalloys and stainless steels. Good for grain size. Swab for up to a few minutes. Can be stored.
<b>Acetic Glyceric acid</b> 15 ml HCl 10 ml Acetic Acid 5 ml HNO <sub>3</sub> 1-2 drops Oxalic (optional)	For superalloys. Use fresh. Discard when turns yellow/orange. Do not store. Swab sample 5-30 seconds.

## Etchants for Titanium and Alloys

<b>Kroll's Reagent</b> 2-5 ml H <sub>2</sub> O <sub>2</sub> 100 ml Distilled Water	Very good etch. Swab 5-10 seconds or immerse sample 10-30 seconds.
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Safety laboratory practices should be followed, consult MSDS of all chemicals used in etch solutions prior to use. Safety is the responsibility of the user. Buehler disclaims all liability with respect to use of these chemicals and etch solutions.



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# Technical Information Guide: Premium Polishing Cloths & Pads

## EUROPEAN/US EQUIVALENCY GUIDE

FEPA (Europe)		ANSI/CAMI (US)		Emery Grit
Grit Number	Micron (µm)	Grit Number	Micron (µm)	
P60	269.0	60	268.0	
P80	201.0	80	188.0	
P100	162.0	100	148.0	
P120	127.0	120	116.0	
P180	78.0	180	78.0	3
P240	58.5	220	66.0	2
P280	52.2	240	51.8	
P320	46.2			
P360	40.5	280	42.3	1
P400	35.0	320	34.3	0
P500	30.2	360	27.3	
P600	25.8			
P800	21.8	400	22.1	00
P1000	18.3	500	18.2	000
P1200	15.3	600	14.5	
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# Grit Equivalency Guide

**Fran Cverna**

A red circular graphic with a gradient, appearing as a partial circle or a stylized arrow pointing to the right, located on the right side of the slide.

## **Grit Equivalency Guide:**

**Steel Heat Treatment Handbook - 2 Volume Set** George E. Totten, 2006-11-14 This reference presents the classical perspectives that form the basis of heat treatment processes while incorporating descriptions of the latest advances to impact this enduring technology The second edition of the bestselling Steel Heat Treatment Handbook now offers abundantly updated and extended coverage in two self contained volumes

**Steel Heat Treatment** George E. Totten, 2006-09-28 One of two self contained volumes belonging to the newly revised Steel Heat Treatment Handbook Second Edition this book focuses on process design equipment and testing used in steel heat treatment Steel Heat Treatment Equipment and Process Design presents the classical perspectives that form the basis of heat treatment processes while *Aviation Unit and Intermediate Maintenance Manual*, 1990

**Analytical Characterization of Aluminum, Steel, and Superalloys** D. Scott MacKenzie, George E. Totten, 2005-10-10 Authored by top researchers this book discusses methodologies to quantify the properties and microstructures of aluminum steel and superalloys It is a unique reference to advanced laboratory techniques in the context of characterization and property evaluation methodologies enabling the evolution of stronger and more function specific compositions Topics include metallography an atlas of microstructures thermal analysis x ray diffraction and residual stress measurement transmission electron microscopy electron backscattering diffraction spectroscopy texture measurement electron momentum spectroscopy positron annihilation spectroscopy and atomic probe tomography

**The Complete Household Handbook**, 2005 The best ways to clean maintain and organize your home Includes laundry and clothes care food and the kitchen storage and home office solutions and safety

**Fluorinated Coatings and Finishes Handbook** Laurence W. McKeen, 2015-10-11 Fluorinated Coatings and Finishes Handbook The Definitive User's Guide Second Edition addresses important frequently posed questions by end user design engineers coaters and coatings suppliers on fluorinated coatings and finishes thus enabling them to achieve superior product qualities and shorter product and process development times The book provides broad coverage of these fluorinated polymer coatings including the best known PTFE polytetrafluoroethylene first trademarked as Teflon and ePTFE GoreTex Their inherent qualities of low surface tension non stick low friction high melting point and chemical inertness make fluoropolymer coatings widely desirable across thousands of industrial and consumer applications but these properties also make it difficult to convert fluoropolymers to coatings that have sufficient adhesion to the substrate to be protected In this book readers learn how fluoropolymer coatings are used and made about their pigments and fillers binders dispersion processes additives and solvents The book includes substrate preparation coating properties baking and curing processes performance tests applications and health and safety Provides a practical handbook that covers the theory and practice of fluorinated coatings including the structure and properties of binders and how to get a non stick coating to stick to the substrate Covers liquid and powder fluorocoatings their applications methods curing and baking processes and their commercial end uses Presents detailed discussions of testing

methods related to fluorocoatings common coating defects how they form how to eliminate them and the health and safety aspects of using and applying fluorocoatings Includes substrate preparation coating properties baking and curing processes performance tests applications and health and safety     Worldwide Guide to Equivalent Irons and Steels Fran Cverna, 2006-01-01 More than 30 000 listings are presented in this edition with increased coverage from major steel producing countries such as China India and Japan     Manual of Geology John Phillips, 1885     **PPI PE Civil Study Guide, 17th Edition** Michael R. Lindeburg, 2022-09-30 Maximize your efficiency while studying for the PE Civil CBT exam by pairing the PE Civil Study Guide with Michael R Lindeburg's PE Civil Reference Manual PE Civil Study Guide Seventeenth Edition provides a strategic and targeted approach to exam preparation so that you gain a competitive edge With hundreds of entries containing helpful explanations derivations of equations and exam tips the Study Guide connects the NCEES exam specifications for all five PE Civil exams to the NCEES Handbook approved design standards and PPI's civil reference manuals The Study Guide is organized to make the most of your time and is an essential tool for a successful exam experience Relevant sections from the NCEES Handbook design standards and PPI's reference manuals are clearly indicated in both summary lists for each exam specification and in each of the detailed entries covering a specific concept or equation Referenced PPI Products PE Civil Reference Manual Structural Depth Reference Manual for the PE Civil Exam Construction Depth Reference Manual for the PE Civil Exam Transportation Depth Reference Manual for the PE Civil Exam Water Resources and Environmental Depth Reference Manual for the PE Civil Exam Referenced Codes and Standards 2015 International Building Code ICC A Policy on Geometric Design of Highways Streets AASHTO AASHTO Guide for Design of Pavement Structures AASHTO AASHTO LRFD Bridge Design Specifications Building Code Requirements Specification for Masonry Structures ACI 530 Building Code Requirements for Structural Concrete Commentary ACI 318 Design Construction of Driven Pile Foundations FHWA Design Construction of Driven Pile Foundations Volume I FHWA Design Control of Concrete Mixtures PCA Design Loads on Structures During Construction ASCE 37 Formwork for Concrete ACI SP 4 Foundations Earth Structures Design Manual 7 02 Geotechnical Aspects of Pavements FHWA Guide for the Planning Design Operation of Pedestrian Facilities AASHTO Guide to Design of Slabs on Ground ACI 360R Guide to Formwork for Concrete ACI 347R Highway Capacity Manual TRB Highway Safety Manual AASHTO Hydraulic Design of Highway Culverts FHWA LRFD Seismic Analysis Design of Transportation Geotechnical Features Structural Foundations Reference Manual FHWA Manual on Uniform Traffic Control Devices FHWA Minimum Design Loads for Buildings Other Structures ASCE SEI 7 National Design Specification for Wood Construction AWC Occupational Safety Health Regulations for the Construction Industry OSHA 1926 Occupational Safety Health Standards OSHA 1910 PCI Design Handbook Precast Prestressed Concrete PCI Recommended Standards for Wastewater Facilities TSS Roadside Design Guide AASHTO Soils Foundations Reference Manual Volume I II FHWA Steel Construction Manual AISC Structural Welding Code Steel AWS     *The Complete Wooden*

*Runabout Restoration Guide* Don Danenberg, 2008-08-15 Now MBI Publishing Company's two top selling boating titles written by one of the world's top authorities on the subject of antique wooden boat restoration are available in one volume. In this comprehensive restoration guide for owners and enthusiasts of wooden powerboats of all makes and models built from the early 1920s through the 1960s, author Don Dannenberg covers all major woodworking aspects of restoration: surveying, disassembly, repair, reconstruction, and varnishing. But when it comes to restoring a classic wooden powerboat, getting the frame, planking, and deck right is just one part of the story. Danenberg also walks enthusiasts through the topics of hardware, running gear, electrical wiring, plumbing, instruments, upholstery, trailers, and maintenance. Fully illustrated with step-by-step color photos and written in an entertaining style in which the author stresses sound reconstruction techniques over preservation of original components, this comprehensive volume also includes resource listings, glossaries, and School of Hard Knocks sidebars.

Manuals Combined - U.S. Army AH-1 Cobra Operator; Aviation Unit/Intermediate, Operator, Organizational, Field and Depot Maintenance; Repair Parts and Special Tool List; Nondestructive Testing; And Maintenance Test Flight Manuals, Over 8 700 total pages. The types of manuals included are: 1 Operator, 2 Aviation Unit Intermediate Operator, Organizational, Field and Depot Maintenance, body turbine engine, electronics, radar, and related parts, 3 Repair Parts and Special Tool List, 4 Nondestructive Testing, 5 Maintenance Test Flight Manual.

**OECD Guidelines for the Testing of Chemicals / OECD Series on Testing and Assessment Report of the SETAC/OECD Workshop on Avian Toxicity Testing** OECD, 2002-05-10. As part of the OECD's Pesticide Programme, a Workshop on Avian Toxicity Testing was held in Pensacola, Florida, on 4-7 December 1994. It was jointly organised by the Society of Environmental Toxicology and Chemistry (SETAC) and the OECD.

**Technical Manual** United States. War Department, 1943. *Technical Manual* United States Department of the Army, 1970.

POTW sludge sampling and analysis guidance document, **Engineering Manual for War Department Construction** ... United States. Army. Corps of Engineers, 1946.

**Food Buying Guide for Child Nutrition Programs** DIANE Publishing Company, 1994-12. Will help ensure that meals served under the National School Lunch/Breakfast Programs meet program requirements. Will help personnel buy the right amount of food, buy it most economically. Gives average yield information on over 600 food items.

*The Travancore State Manual* Travancore (Princely State), V. Nagam Aiya, 1906.

Glass Bead Workshop Jeri L. Warhaftig, Jeri Warhaftig, 2008. Handmade glass beads are highly sought after and command high prices in shops; the best ones are tiny works of art. Teacher and artist Warhaftig has designed this book as a series of ten practice lessons on advanced techniques for experienced beadmakers. Each lesson includes photos of works in progress and finished beads by glass artists. General information encompasses tools and studio setup. An excellent selection for public and academic library/crafts collections. Copyright Reed Business Information, a division of Reed Elsevier Inc. All rights reserved.

*Geologists' Association Guides*, 1996.

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web oct 3 2002 the primary aim of this study is to explore the potential use of different roll forming methods to reduce springback and part shape defects in the cold roll forming of ti 6al 4v sheet and to develop a deeper understanding of the material behaviour of ti 6al 4v in the process

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