

# TIGHTENING TORQUE REFERENCE CHART FOR SAE AND METRIC BOLTS

NL = Not Lubricated  
L = Lubricated  
1 lbs ft = 1.356 N\*m



HEX KEY INTERCHANGE	
SAE	Metric

## TIGHTENING TORQUE FOR SAE BOLTS (30% of yield strength $S_y$ ) in lbs ft

MATERIAL	UNC	1/4"-20	5/16"-18	3/8"-16	7/8"-14	1 1/2"-12	2"-12	2 1/2"-12	3"-10	3 1/2"-9	4"-8	5"-8	5 1/2"-7	6"-7	6 3/4"-6	8"-5
GRADE 1	NL	4	8	14	22	34	45	68	100	194	291	492	581	762	1012	1512
	L	3	6	10	17	26	37	51	90	145	218	309	436	572	759	1102
GRADE 2	NL	6	12	22	35	54	78	107	191	294	492	581	762	1012	1512	2202
	L	5	9	17	27	40	58	81	143	145	218	309	436	572	759	1102
GRADE 5/8.2	NL	10	20	36	57	87	126	173	308	496	743	1053	1486	1948	2589	3854
	L	7	15	27	43	65	94	130	231	372	557	790	1114	1481	1939	2854
GRADE 8	NL	14	28	50	81	123	177	245	435	700	1050	1488	2100	2752	3654	5454
	L	10	21	38	60	92	133	184	326	525	787	1116	1575	2084	2740	4040

MATERIAL	UNF	1/4"-28	5/16"-24	3/8"-24	7/8"-20	1 1/2"-16	2"-16	2 1/2"-16	3"-14	3 1/2"-14	4"-12	5"-12	5 1/2"-11	6"-11	6 3/4"-10	8"-9
GRADE 1	NL	4	9	16	25	38	55	77	104	214	325	482	644	868	1028	1528
	L	3	7	12	19	29	41	58	101	160	245	347	483	651	854	1254
GRADE 2	NL	7	14	25	39	61	87	122	213	214	326	482	644	868	1028	1528
	L	5	10	19	30	46	65	91	159	160	245	347	483	651	854	1254
GRADE 5/8.2	NL	11	22	40	64	98	140	196	343	547	834	1181	1645	2217	2929	4329
	L	8	17	30	48	74	105	147	257	410	625	886	1234	1683	2182	3282
GRADE 8	NL	16	31	57	90	139	198	277	485	773	1178	1689	2325	3133	4111	6111
	L	12	24	43	68	104	148	208	364	580	884	1251	1744	2350	3083	4583

## TIGHTENING TORQUE FOR METRIC BOLTS (30% of yield strength $S_y$ ) in lbs ft

MATERIAL	ST. PITCH	M6-1	M8-1.25	M10-1.5	M12-1.75	M14-2	M16-2	M18-2.5	M20-2.5	M22-2.5	M24-3	M27-3	M30-3.5	M33-3.5	M36-4
CLASS 4.6	NL	3	8	16	29	46	71	98	139	199	240	351	477	549	833
	L	3	6	12	21	34	53	74	104	142	180	263	357	486	625
CLASS 8.8	NL	8	22	44	76	122	190	262	370	509	640	896	1271	1730	2221
	L	7	17	33	57	91	142	197	278	378	480	702	953	1297	1655
CLASS 10.9	NL	15	32	64	112	179	279	385	544	739	940	1375	1887	2540	3263
	L	10	24	48	84	134	209	289	408	555	705	1031	1400	1905	2447
CLASS 12.9	NL	16	38	75	131	209	326	451	636	865	1100	1609	2195	2973	3878
	L	12	29	56	98	157	245	338	477	649	825	1207	1639	2230	2893

MATERIAL	FINE PITCH	M6-0.75	M8-1	M10-1	M12-1.25	M14-1.5	M16-1.5	M18-1.5	M20-1.5	M22-1.5	M24-1.5	M27-1.5	M30-1.5	M33-1.5	M36-1.5
CLASS 4.6	NL	4	9	18	31	50	76	110	154	207	273	393	545	733	958
	L	3	7	14	23	37	57	83	116	156	204	295	409	550	719
CLASS 8.8	NL	10	24	49	83	132	202	294	411	553	727	1048	1455	1954	2556
	L	7	18	37	63	99	151	220	308	415	545	799	1091	1466	1917
CLASS 10.9	NL	15	35	72	123	194	296	431	603	813	1068	1539	2136	2870	3754
	L	11	26	54	92	146	222	323	453	610	801	1155	1602	2152	2815
CLASS 12.9	NL	17	41	84	143	227	347	505	708	951	1249	1822	2500	3358	4393
	L	12	31	63	108	170	260	379	530	719	937	1361	1875	2519	3295

5/16"	2
3/32"	2.5
7/64"	3
1/8"	3.5
5/32"	4
3/16"	5
7/32"	6
1/4"	7
5/16"	8
3/8"	10

# Torque Guide For Metric Bolts

**Larry Holt, John Harold Haynes**



## **Torque Guide For Metric Bolts:**

**Machinist Guide** David B Smith, 2015-04-15 This is a Machinist Notebook Reference guide Revised Apr 11 2015 Written for machinists by a journeyman machinist in a real shop environment With tables charts illustration drawing and Sketches for machinist gunsmith auto industries With work sheets for none standard threading and gear cutting It also has simple illustration on how to make a few simple tooling and aids in the shop information for machinist As listed Three wire Major Diameter worm DP and MOD Using a Dividing Head How use a Compound Indexing How to make the Smith Compound indexer Rebound Ball Hardness Tester Grinding Lathe Tools bits Speeds and lubrication Rebound Ball Hardness Tester Hardness Chart Roughness Finish Compactor Scale Over the wire dimensions inch bolts in mm Index Table for 40 tooth worm 2 to 540 Compound Indexing on 40 tooth worm 51 250 teeth Index Table for 72 tooth worm Index Table for 90 tooth worm 2 230 Gear cutting and blanks This is book with written for fast reading NOT NOVEL for reading for slow reading

**Metric Manual** United States. Bureau of Reclamation, 1978 , **Mechanic & Welder Guide for machinist hand tools** , How to use MICs and Tools used by Machinist In both Inch and Metric History of machine tools With simple how do machine work tricks of the trade Chilton's Ford Windstar 1995-98 Repair Manual , 1998 Covers all U S and Canadian models of Ford Windstar Cover **The Mechanic's Guide to Front-wheel Drive** Larry W. Carley, 1983 **Donny's Unauthorized Technical Guide to Harley-Davidson, 1936 to Present** Donny Petersen, 2010-03-01 Donny is the Winner of the 2012 International Book Awards Donny Petersen has been educating motorcycle enthusiasts about Harley Davidson bikes for years Now he has combined all his knowledge into a twelve volume series masterpiece and this third book is one that every rider will treasure Petersen who has studied privately with Harley Davidson engineers and has spent thirty six years working on motorcycles is sharing all of his secrets As the founder of Toronto's Heavy Duty Cycles in 1974 North America's premier motorcycle shop the dean of motorcycle technology teaches about the theory design and mechanical aspects of Harleys In this third volume discover 1 How to identify the Evolution models 2 Why the Evolution models are better 3 Everything you need to know about engines 4 Troubleshooting every facet of the Evolution And so much more The Harley Davidson Evolution The Japanese had more than quality Their arsenal included acceleration and speed combining with good braking and handling They could design tool up and build a new motorcycle in a mere eighteen months The flavor of the day could easily be accomplished with this organizational skill and dexterity On top of this they had lower prices The Gang of 13 took over a failing company or did they By 1982 Harley Davidson sales went into a tailspin with plunging production The USA was in a deep recession Adding to the perfect storm was the flood of Asian imports that many believe were being sold in the U S below their manufactured costs Whether this was true or not how did a small country a half world away manufacture a quality product that was faster handled better and was less expensive Furthermore these import motorcycles were more functional Well of course they did because USA motorcycle manufacturing offered old clunker styling

that was slower did not handle well and broke down all the time And for all of this Harley Davidson s cost more Insulting if one thinks about it It is not that the Evolution was that good relative to their competitors because in my opinion it was not However the Evolution was stellar relative to what went before I was a loyal Shovelhead rider necessarily becoming a mechanic along the way I like the rest of my ilk would never consider riding any other product I did not care that a Honda might be functionally better less expensive and not require my newfound mechanical skills Honda simply did not give what my psyche craved Importantly H D dropped its lackadaisical attitude towards copyright infringement particularly with knock off products Harley Davidson became extremely aggressive against the counterfeiting of their trademarks It licensed use of its logos with all manner merchandise that was embraced by mainstream America followed by the world including the Japanese H D then saw the birth of HOG the most successful marketing and loyalty campaign in the annals of corporate sustenance The world embraced this pasteurized version of the outlaw subculture You might meet the nicest people on a Honda but Harley riders are all about cool They adapt a pseudo outlaw lifestyle that emulates freedom and individualism They spend much of their time adopting one charity or another to prove they really aren t bad Many charities benefitted greatly during the Harley boom Can these riders be contesting the Honda mantra of niceness The previous owners AMF deserve much credit for the success of Harley Davidson They gave the Gang of 13 a platform from which to launch These new guys were brighter than bright They put a management team together that knew no bounds in success I am sure that Marketing 101 in every business school teaches and will continue to teach their brilliant story Harley Davidson became the epitome of American manufacturing and marketing the darling of capitalism at its finest Think about it How could a rusty old manufacturer whose time had drifted by reach such pinnacles of success Well H D had a little help along the way with two main sociological factors 1 The post World War II baby boom the aging bulge in American demographics looking for adventure and whatever safely came their way 2 A generation that worked hard raised families and then looked back at what they had missed in their youth Harley Davidson embodied the freedom and adventure they lacked Harley Davidson was granted two decades in which to plan a lasting and viable future It sought to be the motorcycle of mainstream America The world would follow This venerable company almost pulled it off The Motor Company updated technology both in their manufacturing venue and in the product itself H D balanced on a near impossible fulcrum maintaining tradition on one side and complying with environmental dictates on the other The Evolution s successor the air cooled Twin Cam introduced in 1999 with great success H D continued to grow and prosper I have always viewed the Twin Cam as a transitional model embracing the past but leading into a future of overhead cams and water jackets The new H D V Rod s technological marvels are a wonderful attempt but as much as the Factory hoped mainstream Harley riders did not take the bait en masse After all they had their psychological needs These attempts did not prevent dark clouds from appearing on the horizon 1 Inexorably the post World War II baby boom s bulge has grown older losing interest in reclaiming youth with interests shifting

elsewhere Who is to take over this downsizing market Who will be left to support the Motor Company in the style it has become accustomed 2 In my humble opinion the masters of marketing did not fill the coming void of consumers I think H D is good at pretty much everything except lowering prices for the incoming generations Nor have they developed affordable and desirable product lines for the youth Certainly the Factory began to enjoy economies of scale in manufacturing I for one do not think they have used their profits wisely for continued prosperity Will I continue to ride a Harley at age 62 Sure I will but I was riding them before they became cool I am not a dentist looking for a safe walk on the wild side or a movie star acquiring the in bauble of the day The Evolution motorcycle saved the Hog s bacon but a new savior is now required

Chilton's Ford ,1998      **How to Ride a Motorcycle: A Rider's Guide to Strategy, Safety and Skill Development**

Pat Hahn, A beginner s manual especially geared to the needs of entry level riders this book provides all the basic instruction necessary to become a motorcycle rider with an emphasis on the challenges faced by neophyte riders Starting at neophyte level and evolving into a serious intelligent expert How to Ride a Motorcycle tells the reader how to be a motorcycle rider with a strong emphasis on safety and big picture strategy think about it this way as opposed to do this      *Guide*

*Specifications for Highway Construction, 9th Edition* ,2008

**Porsche 928s Timing Belt Manual ,      Zinn & the Art of**

**Road Bike Maintenance** Lennard Zinn,2024-06-25 Join the millions of cyclists who swear by the name Zinn Now in its sixth edition Zinn the Art of Road Bike Maintenance is the world s best selling guide to bicycle repair and maintenance Zinn the Art of Road Bike Maintenance is the world s best selling guide to bicycle repair and maintenance From basic repairs like how to fix a flat tire to advanced overhauls of drivetrains and brakes Lennard Zinn s clearly illustrated guide makes every bicycle repair and maintenance job easy for everyone Lennard Zinn is the world s leading expert on bike maintenance and repair His friendly step by step guide explains the tools you ll need and how to know you ve done the job right The book s interior is easy to read even in a dimly lit garage or workshop Hundreds of hand drawn illustrations and exploded parts diagrams show just the right level of detail to lead you through every bicycle repair task In over 450 pages Zinn s guide includes simple instructions for hundreds of bike maintenance and repair jobs including Basics How to fix a flat tire lube a bicycle chain adjust the brakes Emergency repairs How to fix a broken chain tighten loose spokes repair a bent derailleur Easy shifting How to adjust shifters derailleurs and cables for clean and smooth shifting Wheels How to true a wheel install a new tire change a cassette replace broken spokes build your own wheels Overhauls How to service and replace pedals chains and chainrings saddles handlebars stems headsets forks bottom brackets New tech How to maintain 11 speed systems electronic and wireless shifters disc brakes Cyclocross How to set up a cross bike for racing select the right components and make quick repairs Troubleshooting How to figure out what s wrong with any bike and fix it Zinn the Art of Road Bike Maintenance makes bicycle repair and maintenance easy quick affordable and fun With Zinn at your side you ll know how to keep your bicycling running smoothly for years      *Index of Specifications and Standards ,      Zinn & the Art of Road Bike*

**Maintenance** Lennard Zinn, 2023-10-24 Zinn all bottom bracket systems cone and cup through press fit all brake systems including caliper V brake cantilever and disc all headset stem handlebar and fork systems wheelbuilding for all bikes including cyclocross and disc brake wheels special sections on cyclocross throughout including troubleshooting maintenance service repair and equipment selection updated and expanded torque tables complete illustration index and complete subject index

Illustrated Theatre Production Guide John Ramsey Holloway, 2014-06-20 Illustrated Theatre Production Guide delivers a step by step approach to the most prevalent and established theatre production practices focusing on essential issues related to the construction of wooden fabric plastic and metal scenery used on the stage A must have resource for both the community theatre worker who must be a jack of all trades and the student who needs to learn the fundamentals on his or her own it covers the necessities in great detail without bogging you down Offering techniques and best practice methods from an experienced industry expert it will allow you to create a foundation on which to build a successful and resourceful career behind the scenes in theatre production This third edition has been completely restructured to more effectively lead you through the basics of stagecraft Through detailed lessons and hundreds of drawings author John Holloway offers you solutions to the problems that you ll face every day in a production from rigging to knot tying New to this edition are guides to jobs in theatre construction documentation and video projection methods with expanded information on Thrust Theatres lighting audio and video practices This book is suitable for Stagecraft courses in university Theatre programs as well as for professional theatre technicians

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Illustrated Theatre Production Guide Emeritus Professor of English John Holloway, John Holloway, 2013-03-20 Completely expanded and remodeled new edition of this unique look at theatrical scenery construction

**Chilton's General Motors Chevette/1000 1976-88 Repair Manual** Christine L. Nuckowski, 1997 Covers all U S and Canadian models of Chevrolet Chevette and Pontiac 1000 Cover

Handbook of Bolts and Bolted Joints Sayed A. Nassar, John H. Bickford, 2025-03-20 Presenting time tested standards as well as validated emerging knowledge on threaded fasteners and bolted joints this updated edition covers how to design select parts and materials control assembly processes predict behavior and solve on the job problems This handbook examines key issues affecting bolting in the automotive pressure vessel petrochemical aerospace energy and structural steel industries The editors have successfully created a useful rather than scholarly handbook with chapters written in a straightforward how to manner Theory is discussed only when necessary and the handbook s logical organization and thorough index enhance its usefulness Handbook of Bolts and Bolted Joints Second Edition includes updated chapters solved

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Larry Holt, John Harold Haynes, 1990 Covers Subaru 2WD and 4WD sedan hatchback station wagon XT and Brat pick up 1980 thru 1989 With step by step procedures

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