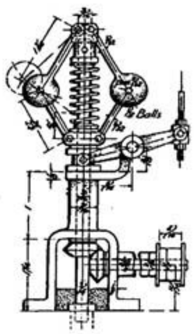

The NEMES Gazette
New England Model Engineering Society Inc.

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NEMES web site

http://www.neme-s.org

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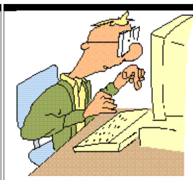


Editors Desk

Bill Brackett

It should be an honor, a privilege and a rewarding experience to be president of an organization. Not so with NEMES, it seems to be a dreaded position. This needs to be changed to prolong the life of our club.

Several months ago the formation of the program committee, lead by Norm Jones, has relieved that responsibility from the president. The duties now mainly consist of hosting the meetings and being a liaison to the museum. Further changes need to be made in order to make the office of president a sought after position.

First I would like to suggest a two year term with a maximum of two terms. This would limit the commitment to a minimum of two years and a maximum of four.

Next we need to form a nominating committee which would operate independent of the existing officers, to ensure we have capable and willing candidates to take over vacated positions.

I hope this is food for thought and will invoke a discussion at our next meeting.

Issue	Contribution Due
AUG	JUL 20, 2012
SEP	AUG 24, 2012
OCT	SEP 21. 2012

Next Meeting

Thursday, June 7th 2012

7:00 PM. Meetings held at:

Charles River Museum of Industry
154 Moody Street
Waltham, Massachusetts

Membership Info

New members welcome! Annual dues are $25 (mail applications and/or dues checks, made payable to "NEMES", to our Treasurer Richard Koolish, see right) Annual dues are for the calendar year and are due by December 31st of the prior year (or with application).

Missing a Gazette? Send a US mail or email to our publisher. Contact addresses are in the left column.

Contents

President's Corner

Dick Boucher

The Meeting

This month is our very special meeting. Ron Ginger coined the term "Poster Session" for our informal get togethers. It is a great time to bring in our latest projects whether finished or in progress, even something you have brought in before. The point is in order for the evening to be truly enjoyable everyone has to bring something to show.

Miscellaneous Ramblings

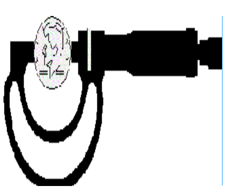
Not much to talk about on ramblings. Bea and I haven't been anyplace in the last month. I have had another long-term substitute call at the North Shore Technical High School. I was working in the Collision Repair shop. This was a great assignment as the regular instructor talked me into getting the dents pulled and the truck repainted. It now looks almost brand new. I say almost brand new because I still use it as a truck and have managed to put a couple light scratches on the sides of the bed.

Another note of interest, our own Bruce Murray gave his talk on his Jaguar engine project to the machine tech classes at both the Whittier Vo-Tech and North Shore Regional Tech (at different times). Both presentations were well received. The instructors we very grateful for Bruce's thoroughness of the presentation and a couple of the young fellows from North Shore who I have worked with have shown an interest in coming to our meetings. Thanks Bruce for your time and effort

Other than that I have been busy de-assessing as it were of a lot of things that I will never get to and basically were masses of rust just waiting to converted to something else after passing through the local resources recovery facility (junk yard). I have the shop well under control and the room above the shop nicely cleared out all I have to do now is to move all the stuff I cleared out of those areas into the barn back from the barn into the other areas.

I am writing this on June 22nd and have spent the last couple days hanging close to my air-conditioned shop. If the weather breaks tonight Bea and I hope to get to the Engenuity Show at Orange Airport tomorrow.

Dick B



Tool Corner

Frank Dorion

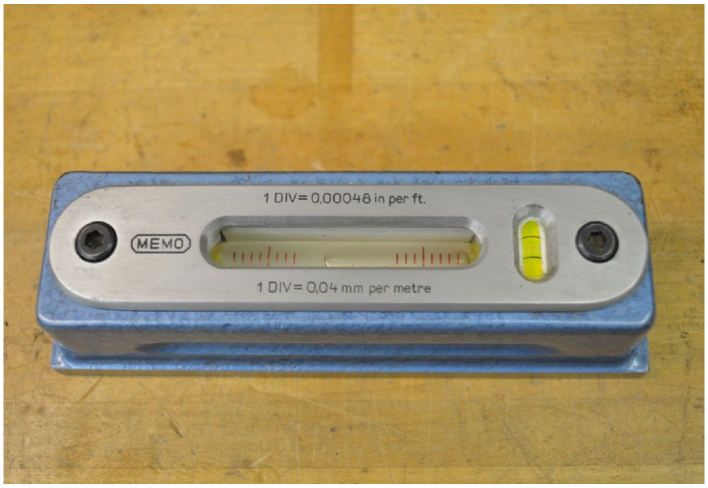
The level is an important, even critical, tool for the machinist. The more accurate versions are highly sophisticated, but deceptively simple in appearance. It's worth taking a close look at the different types of machinist's level, how they are made, how they work, and how to use them properly.

Let's first take a look at some of the different types of machinist's levels out there. There are two general grades of these levels commonly found in most shops. The more common of the two is typified by the Starrett No. 98 series shown below.

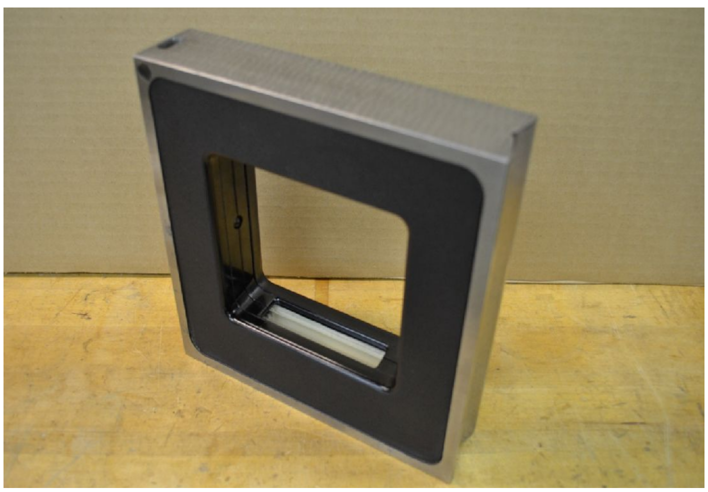
These levels are quite accurate, but not the ultimate in precision. They come in several different lengths ranging from 4" to 18" and they have a V-grooved bottom so they can be positioned easily on a round shaft. On the 6" and longer sizes, a cross vial permits leveling in two directions, important if you are checking a round shaft as the level may not give an accurate reading on the long axis if it's inadvertently canted off to one side. The rotating cover for the level vial is a much-appreciated feature on this style level as it prolongs the life of the delicate glass vial considerably. Similar levels were made by many other companies over the years, but Starrett is now the predominant producer of this style in the US.

Moving into the high precision group, another selection from the Starrett line has become the standard for precision, mostly by default, as other manufacturers have fallen by the wayside. Starrett's No. 199 Master Precision Level is 15" long with a cross vial, a flat hand-scraped bottom and an insulated handle to prevent heat transfer to the level from handling. Here's what it looks like:

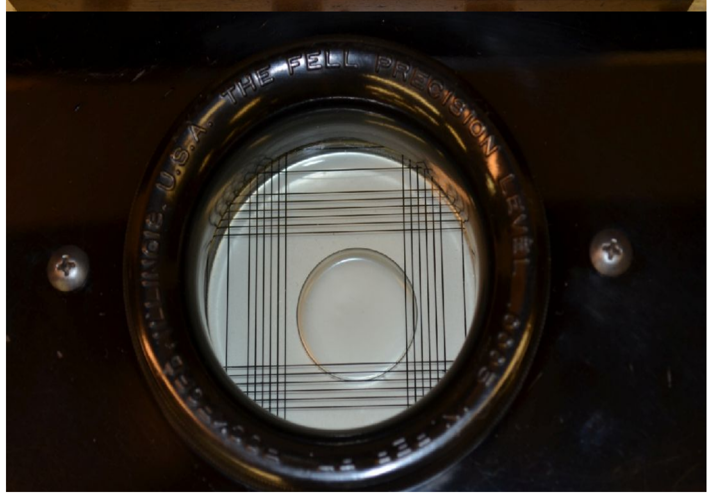
High precision levels are also available from other sources in a variety of formats. For example, here is a high quality 6” version made in Sweden:



In addition to these conventional shapes there are some less common high precision level styles. One is the frame level which is often used by machine builders and millwrights who are setting up precision machinery. The frame level provides a very accurate means of checking machine components for both level and plumb. The one below is a Russian-made version. To give you an idea of its size, it measures about 8” on each side and is 1-3/4” thick. The entire interior of the square frame is lined with an insulating plastic material.



Last, and probably quite rare these days is a precision circular level, again used for machine set-ups and other similar high precision leveling tasks. This one is an old-timer, the Fell Precision Level, and its beautiful mahogany case tells you its contents are something special before you even open it. This level is highly accurate in both directions and the bubble clearly indicates the actual slope of the surface you are leveling rather than giving a uni-directional reading like its counterparts above. The Fell Precision Level is a big tool; it measures 5-1/2” wide by 12” long and weighs 14 pounds.



Let’s examine how a level works. In his Model Engineer’s Workshop article on building precision levels, Bill Morris, an English model engineer, gave the best and most succinct description I’ve seen: “One way or another, the inside of a sealed glass tube or vial is curved. It is partly filled with a fluid, usually alcohol, but sometimes ether or acetone. Gravity pulls the fluid down, leaving the bubble at the top of the curve. Horizontal is defined by the two ends of the bubble [i.e. their relative heights]. . . . the larger the radius of the curve, the more the bubble moves for a given change in angle.” And therein lies the explanation of why some levels are more accurate than others. Assuming the interior of the vial is made truly round, the increase in a level’s accuracy is achieved by increasing the radius of the vial’s end to end curve. As you go up the scale in accuracy, ground glass vials become the norm and their radius of curvature increases, making the bubble more sensitive to the vial's movement.

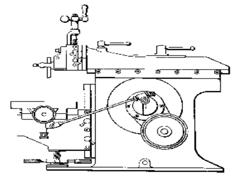
Like many other things, a level's accuracy is relative. To get an idea of what scale we are contemplating, let's start by looking at the common carpenter's level. In his book, Measure Twice, Cut Once, Norm Abrams discusses carpenters levels: "Air bubble levels are graded in arc-minutes; 60 arc-minutes equal a degree. Many levels are sold with a 45-arc-minute rating, meaning that the pitch of the level could be changed up to almost three quarters of a degree without causing any movement in the bubble. But you shouldn't be satisfied with a rating above 35-arc-minutes and you can get vials accurate up to 5 arc-minutes." So, in Norm's work as a carpenter, a level rated for 5 arc-minutes would be considered top of the line.

Now let's move up the scale in accuracy to the machinist's level typified by the Starrett Model 98 series. The Starrett catalog rates the accuracy of the Model 98 levels at 0.005" per foot, which equates to approximately 1-1/4 arc minutes, almost 5 times more accurate than Norm's best level. So, you're thinking, "That Model 98 is a pretty good level, isn't it?" Maybe, but let's see what the next step up the accuracy scale brings

Starrett's Model 199 Master Precision level is regarded as the standard for accuracy in many shops. Looking at the specs tells you why. Starrett states that the Model 199 is accurate to 0.0005" per foot which translates to 8.6 seconds of arc! This makes the Model 199 ten times more accurate than the Model 98 above, an order of magnitude difference. To make this degree of accuracy clear, the bubble on a Model 199 moves a full 1/10 of an inch (one graduation) for every 8.6 arc-seconds of tilt. This is the level of accuracy at which the term "master precision" begins to be applied. All of the levels shown in the high precision group above meet this standard or better.

And the readily available degrees of accuracy don't stop there. If you are so inclined, it won't take too much shopping in the tool catalogs to find levels rated to 0.02mm per meter. That is equivalent to 4.1 arc-seconds, twice as sensitive as Starrett's best.

After all this one-upmanship talk on accuracy, you might be left feeling that the best way to go (if your budget permits!) is to get the most accurate level you can find. However, if you did so, you might find yourself quite disappointed with your choice. Next time, we'll talk about choosing the appropriate level for the job and how to use it.



Metal Shapers

Kay Fisher

R. G. Sparber's Gingery Shaper - Part 26

Adding the Index and Ruler

Index and Ruler   Photo by R. G. Sparber

I filed a narrow groove in the top of the block and applied some red nail polish. You can see the prototype ruler taped to the disk. I got turned around and put the numbers on the bottom rather than the top but I quickly fixed the artwork.

The plastic version will be trimmed a bit closer so the lines extend to the edge and the curved lines are removed. You can see that I have drawn in the screw holes too.

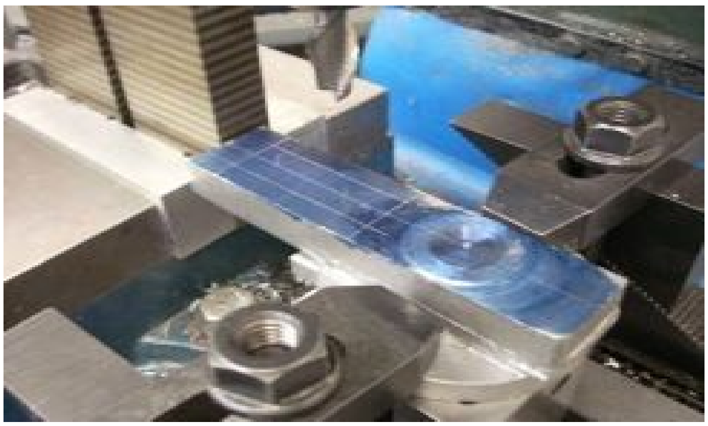
Groove in Mandrel   Photo by R. G. Sparber

Before I can saw off the mandrel, a groove must be cut to prevent the ram's locking bolt from upsetting the pivot rod and causing binding. This is easy to do while the mandrel is intact. Once cut, it would be a lot harder to do.

I then cut off the top end of the mandrel, put it in my lathe's three-jaw chuck, and squared the end. Last, I center drilled it just enough to identify the center. This mark will be useful as I set the part up on my mill/drill.

Aligning Head Photo by R. G. Sparber

The first step is to set the downfeed head such that the pad is aligned with the X axis of of the mill. My vise is true so I used a square to transfer that orientation to the casting.



Pocket Marked on Mill Photo by R. G. Sparber

The pocket has been marked out. I will take a series of 0.050" deep cuts with a $^{5}/_{8}$" end mill. Gingery called for a pocket but I believe that was because it would be too difficult to mold a hole. I chose to just mill all the way through. While I'm at it, I will take a light cut across the top of the pad since I must clean up around the pivot rod anyway.

First Pocket Cut Photo by R. G. Sparber

I have taken a 0.01" deep cut just to verify my layout and cutter position.

Pocket Snag Photo by R. G. Sparber

All was going fine when suddenly the cutter snatched the side of the hole and took a bite. I'm not sure why the part moved. It was clamped down rather tightly but obviously not tight enough. I realigned the slot using the cutter as my gage and finished the hole.

Protractor Mounted Photo by R. G. Sparber

Except for that little bite out of the side of the hole, the pad came out OK. I used WD40 as I cut the aluminum and then changed to cutting oil when milling through the CRS pivot rod.

I have now machined all castings from my last batch. Doing foundry work is going to be a little difficult because we are now in monsoon season. Rain storms blow up quickly plus the combination of high temperatures and high humidity is no fun to work in when wearing full protective gear. Well, I can at least make patterns and hope for a few days of dry weather.

Stay Tuned for part 27 from R. G. Sparber next month.

Keep sending me email with questions and interesting shaper stories.

My email address is:
KayPatFisher@gmail.com

Kay

Circuit Corner

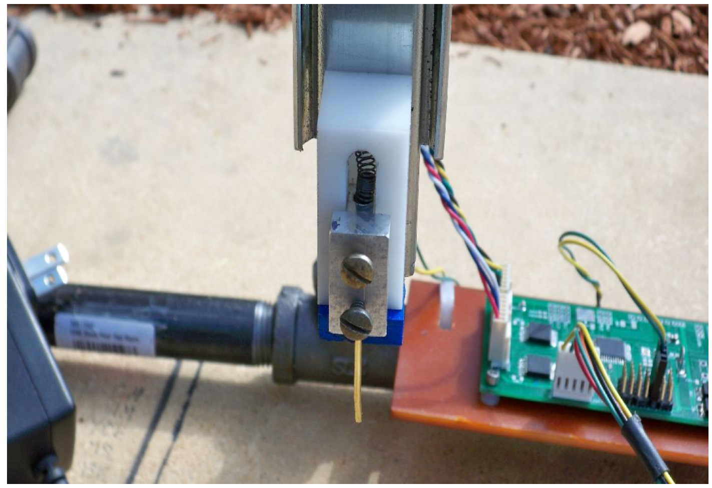
George Gallant

The mechanical components for the EDM electrode up/down movement are in place. Many thanks to Bill Brackett for his labor and use of his shop. The electrode down repeats to an accuracy of less than 0.001”. I am hoping that the backlash is somewhat constant and can be removed in software if necessary

Most of the structure is off the shelf hardware store stock: ½ pipe for the frame, drawer slide for the quill, 3/8 brass threaded rod for the lead screw. The Teflon and aluminum was supplied and machined by Bill. Bill also faced the cast footer that is being used to fix the slide to the frame.

The coupling between the 5mm stepper motor and the 0.25 lead screw was made with some shaft couplers from Jameco. They come in three shaft diameters (5mm, 0.125”. & 0.25”) with a common rubber spider.

As a security feature, we fabricated a spring loaded slide mechanism for the electrode. This way if (when) I drive the electrode hard into the work there will be some give.



The electronics have not progressed one iota. The processor board contains a dsPIC from a prior project with 2 h-bridge motor controllers. I am bit-banging the 4 I/O ports to control each of the 4 stepper motor wires. The code is remarkable simple, assert each of the 4 wires in sequence. The pulse width essentially sets the rotational speed. There is a minimum pulse width that is required to make the mechanism turn. This was determined experimentally.

The stepper motor has 6 leads A+, A- Acom, B+, B-, Bcom. If The commons are positive (12V) then we sequentially drive the A/B lines low. With the h-bridge, we do the opposite, set the common lines to ground and assert the AB high. The sequence for rotation in one direction is A+, B+, A-, B-, A+ etc. To rotate n the other direction repeat in the reverse order.

A useful enhancement is to assert the next signal half way thru the current cycle. This greatly increases the delivered torque. I have to figure out what to do on the last step.

Code for the stepper motor can be found on the NEMES wed site under Projects/edm/code.

Threads

David Rysdam

Preliminaries

The easiest way to put a thread on a piece of metal is to use a tap and/or die. But let’s say you need to make a size that won’t appear in the tap and die sets that are priced within range of an ordinary mortal. Like 1 1/8″ diameter.

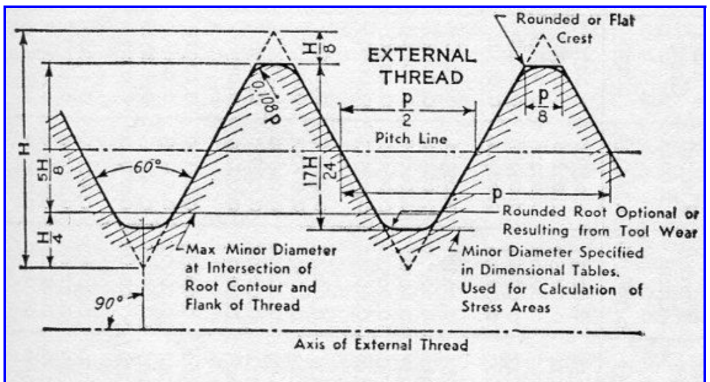
If the tap and die won’t work, you’ll need to move to the lathe to cut it single-point style. The next most common tip is to cut it to fit the intended mating part. Start cutting in the normal way and stop when it fits. But let’s say you have no mating part yet because you are making both halves, bolt and nut. (In actual fact, I’m making a boiler body and screw-on lid.)

OK, you don't have **the** mating nut but you could just use **a** nut of the right size for testing when you cut the boiler threads, then use the boiler threads to test the while cutting the lid. But a single 1″ diameter nuts cost like $5 and would only be used once. My hardware store didn't have 1 1/8″ anyway. Besides, a test nut is not compulsory, merely a convenience. It should be possible to do both halves and know they are going to fit.

There's also one other factor that complicates things. Real 60° threads have flat tops, not pointy ones. The thing I see most people advocating online is to cut them with pointy tops and then file them flat. However, then you aren't at the right diameter anymore. This usually doesn't matter but it still annoys me. (If you don't file them flat, they are painfully sharp.) You could also just not cut them so deep and leave the top flat but how "not so deep" do you cut them? That's exactly the question I intended to answer.

Details

Here we have the thread geometry diagram from my 1950′s Machinery's Handbook. This is for external threads.



(H = height of sharp V-thread = 0.86603 X pitch)

There are a bunch of lines drawn in there. We don't care about most of them for right now. We care about the lines showing the total depth of thread from (truncated) top to (**untruncated**) bottom. 1 You can see that the truncated top is labeled "H/8″ so the rest of it is 7/8 H. What is H?

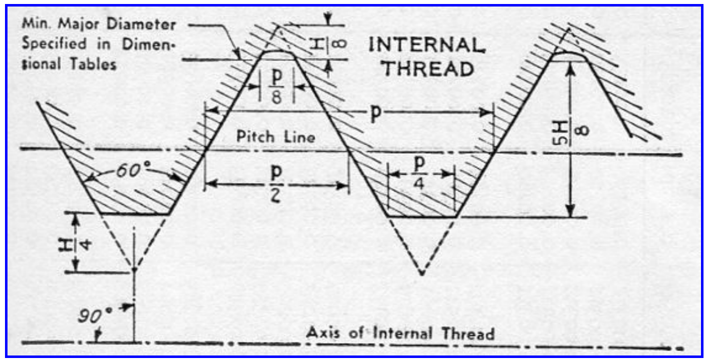
H is the height of the thread. Since this is a 60° thread, that is sqrt(3)/2 of the thread pitch (which is the base of the equilateral triangle formed by each idealized thread). Thus the note at the bottom of the illustration which says that H is .8660 * pitch. sqrt(3)/2 = .8660.

So now we are good, right? Not quite. I actually don't care about thread depth itself at all because I can't measure it. (There is some method involving wires, but this is actually a lot easier in the end.) **What I care about is how far to feed in the compound.** This is not a value given by any table, which is why I'm on this adventure in the first place.

The compound is set to 30°2. That basically means we can omit the .8660 nonsense. Or, put another way, we'll be feeding the tool down the side of one thread. If that thread were a full sharp 60° thread, that distance would be equal to the thread pitch. But since we are omitting 1/8 of the top of the thread, we omit 1/8 of the distance we feed the compound, too.

What about internal threads?

The argument is exactly the same here except that the illustration shows the truncated "top" of the thread is H/4, so the total depth will be 3/4 H.



What To Do

So here is the total procedure after choosing diameter and thread pitch (I'm using 1 1/8″ and 12 tpi):

For the external thread ("bolt")

1. Cut the work to that diameter, in this case 1.125.
2. If you want a relief, cut it to a depth of at least 7/8 * .866 * thread pitch, which is the total thread depth measured perpendicular to the work. You'll want .005″-.010″ beyond that, probably. In my case, that's 7/8 * .866 * 1/12 + a little = .070, read on the cross-slide.
3. Cut threads as usual and measure the depth on the compound until you reach 7/8 * thread pitch. In my example, this is 7/8 * 1/12 = .073, read on the compound.

For the internal thread ("nut") you'll also need to either do an additional calculation (which I'll leave to you to figure out) or look up an additional number. That's the inside diameter of the hole you will be threading, which is known as the "minor diameter". Since this is a 1 1/8″ 12tpi thread, that's where I look on the chart.

Size	Basic Major Diam. Inches	Thds. per Inch	Basic Pitch Diam. Inches	Minor Diam. Ext. Thds. Inches	Minor Diam. Int. Thds. Inches	Lead Angle, Pitch Diam. Deg. Min.	Area, Minor Diam. Sq. In.	Stress Area, Sq. In.
FINE THREAD SERIES								
0 (.060)	0.0600	80	0.0519	0.0447	0.0465	4° 23′	0.0015	0.0018
1 (.073)	0.0730	72	0.0640	0.0560	0.0580	3° 57′	0.0024	0.0027
2 (.086)	0.0860	64	0.0759	0.0668	0.0691	3° 45′	0.0034	0.0039
3 (.099)	0.0990	56	0.0874	0.0771	0.0797	3° 43′	0.0045	0.0052
4 (.112)	0.1120	48	0.0985	0.0864	0.0894	3° 51′	0.0057	0.0065
5 (.125)	0.1250	44	0.1102	0.0971	0.1004	3° 45′	0.0072	0.0082
6 (.138)	0.1380	40	0.1218	0.1073	0.1109	3° 44′	0.0087	0.0101
8 (.164)	0.1640	36	0.1460	0.1299	0.1339	3° 28′	0.0128	0.0146
†10 (.190)	0.1900	32	0.1697	0.1517	0.1562	3° 21′	0.0175	0.0199
12 (.216)	0.2160	28	0.1928	0.1722	0.1773	3° 22′	0.0226	0.0257
1/4	0.2500	28	0.2268	0.2062	0.2113	2° 52′	0.0326	0.0362
5/16	0.3125	24	0.2854	0.2614	0.2674	2° 40′	0.0524	0.0579
3/8	0.3750	24	0.3479	0.3239	0.3299	2° 11′	0.0809	0.0876
7/16	0.4375	20	0.4050	0.3762	0.3834	2° 15′	0.1090	0.1185
1/2	0.5000	20	0.4675	0.4387	0.4459	1° 57′	0.1486	0.1597
9/16	0.5625	18	0.5264	0.4943	0.5024	1° 55′	0.1888	0.2026
5/8	0.6250	18	0.5889	0.5568	0.5649	1° 43′	0.2400	0.2555
3/4	0.7500	16	0.7094	0.6733	0.6823	1° 36′	0.3513	0.3724
7/8	0.8750	14	0.8286	0.7874	0.7977	1° 34′	0.4805	0.5088
1	1.0000	14	0.9536	0.9124	0.9227	1° 22′	0.6464	0.6791
1	1.0000	12	0.9459	0.8978	0.9098	1° 36′	0.6245	0.6624
1 1/8	1.1250	12	1.0709	1.0228	1.0348	1° 25′	0.8118	0.8549
1 1/4	1.2500	12	1.1959	1.1478	1.1598	1° 16′	1.0237	1.0721
1 3/8	1.3750	12	1.3209	1.2728	1.2848	1° 9′	1.2602	1.3137
1 1/2	1.5000	12	1.4459	1.3978	1.4098	1° 3′	1.5212	1.5799

1. Bore the work to size, in this case 1.035.
2. If you want a relief, cut it to at least **3/4** * .866 * thread pitch. Again, this is perpendicular. In my case, that’s 3/4 * .866 * 1/12 + a little = .060″, read on the cross slide.
3. Cut threads as usual, with the compound swung to the *left* and feeding *out*ward until the reading on the compound is 3/4 * thread pitch, or in my case 3/4 * 1/12 = .063″, read on the compound.

For a looser fit, feed the compound in a few extra thousandths.

Footnotes:

1. Why untruncated at the bottom? Because the tool you are using is probably not truncated either. So you want to cut all the way to the dotted line at the bottom of the sharp thread so you get the full width of the real thread at the real bottom. If your tool has a flat ground on the end to get the right width, you aren’t reading this post.
2. OK OK, actually I’m set to 29° per standard practice. It doesn’t change the math appreciably.

NEMES Shop Apron

Rollie Gaucher
508-885-2277

Look your best in the shop! The NEMES shop apron keeps clothes clean while holding essential measuring tools in the front pockets. The custom strap design keeps weight off your neck and easily ties at the side. The apron is washable blue denim with an embroidered NEMES logo on top pocket.

Upcoming Events

Bill Brackett

To add an event, please send a brief description, time, place and a contact person to call for further information to Bill Brackett at events@neme-s.org

Calendar of Events

July 5th   Thursday 7PM
NEMES Monthly club meeting
Charles River Museum of Industry 781-893-5410
Waltham, MA

June 30th Antique Engine Meet & Tractor Meet
Boothbay Railway Village
Rt 27 Boothbay ME
www.railwayvillage.org

July 8th Pepperell Show
RT 111 Pepperell, MA Ken Spalding 978-433-5540

July 15th 9:00am The Flea at MIT
Albany Street Garage at the corner of Albany and Main Streets in Cambridge

July 27th -28th   Eliot Antique Tractor & Engine Show
Raitt Homestead Farm, Rt 103
Eliot ME. Lisa Raitt 207-748-3303

Aug 2nd   Thursday 7PM
NEMES Monthly club meeting
Charles River Museum of Industry 781-893-5410
Waltham, MA

Aug 5th Belltown Antique Car Club
46th annual summer show
East Hampton Ct
http://www.belltownantiquecarclub.org/shows/engine%20show%20main.htm

Aug 4-5th Scribner’s Mill Show
Sebago Lake Region near Harrison ME
207-583-6455

Aug 11th -12th Straw Hollow Engine Show
Boylston, MA
J. A. Resseguie 508-869-2089

Aug 18th -19th Race of the Century
The Collings Foundation
137 Barton Road in Stow, MA Cost at gate: $15 Adults
http://www.collingsfoundation.org/cf_OpenHouseEvents12.htm

Aug 19th 9:00am The Flea at MIT
Albany Street Garage at the corner of Albany and Main Streets in Cambridge

Aug 24-26th 42nd Annual Meet
Waushakum Live Steamers
Holliston MA
http://www.waushakumlivesteamers.org/

Aug 30th –Sept 1st Vermont Gas & Steam Engine Assoc show
Intersection Rte 100 and Rte 107 Stockbridge VT
Gail Norman 802-485-8224