

6-M-----STANDARD PRACTICE-----July 7, 1949

Shop Detail Drawings

Tolerances

Unless otherwise specified the following tolerances will apply:

Lineal dimensions	*finished surfaces	- Fractional inches	plus or minus	1/64"
"	"	- Decimal	"	.005"
"	"	- Millimeters	"	.4MM
"	**rough	- Fractional	"	1/32"
"	"	- Millimeters	"	.8MM
Diameters	*finished surfaces	- Fractional	"	.005"
"	"	- Decimal	"	.002"
"	"	- Millimeters	"	.1MM
"	**rough	- Fractional	"	1/64"
"	"	- Millimeters	"	.4MM
Squareness	- *finished surfaces with axis		total	0° 30'
Concentricity	"	"	"	.003"
Angularity	"	"	"	0° 30'
Squareness	**rough	"	"	2° 0'
Concentricity	"	"	"	1/64"
Angularity	"	"	"	2° 0'
Roundness	- *finished surfaces	- Fractional inches	plus or minus	.001"
"	"	- Millimeters	"	.2MM
"	**rough	- Fractional	"	1/32"
"	"	- Millimeters	"	.8MM
Flatness and centerline straightness				
	*finished surfaces	- Fractional inches	"	.001" in
	"	- Millimeters	"	.02MM in 50
	**rough	- Fractional	"	1/32"
	"	- Millimeters	"	.8MM

* machined, precision and die casting

** sand cast and forged

Methods of Dimensioning

Dimensions will not be repeated unless necessary.

Tying up dimensions will be omitted, where used "tying up" dimension will be marked (ref.).

Dimensions will be applied first to suit function of part, second to facilitate production.

Unless otherwise specified, the following information will apply:

Threads

Depth of tap drills to extend past the thread the equivalent distance of 1-1/2 to 2 turns

MZ-SP-1

6-M-----STANDARD PRACTICE-----July 7, 1949

Depth of perfect thread will be dimensioned on drawing designation for depth of thread.

Length of perfect male thread will extend within the equivalent of 1-1/2 to 2 turns from the shoulder.

Chamfer end of threads to be 45° and 1.25 times the depth of the thread.

Patterns

Cast lettering as per Engineering Dept. instruction.

Allowance for finishing surfaces as per shop instruction.

Radii of fillets to be 1/16" + 1/32" unless otherwise specified.

Corners to be rounded up to 1/16" + 1/32" R. unless otherwise specified.

General

All burrs and fins to be removed.

Type of finish to be indicated for all machined surfaces.

Material to be designated to standard specifications.

Special scale must be designated on all views not made to scale of the entire drawing.

All drawings must indicate as much as possible the true intersections.

Junctions of cast and machined surfaces must be shown in true manner.

S. Shakin

7/6/49

MI-SP-2

3-M-----NATHAN MANUFACTURING COMPANY-----July 7, 1949

Standard Steam Metals

No. 2 metal (casting)

Chemical analysis - 85% copper, 5% lead, 5% tin, 5% zinc.

Recommended for general steam use up to 250 psi pressure or up to 2" pipe size units for pressure to 300 psi saturated steam. Also for parts on steam appliances not exposed to steam. It is suitable for use with steam temperatures up to 400°F.

Authorities and References:

A.S.T.M. Spec. B-62
 American Foundry Association Table 59 Alloy #2
 S.A.E. Composition #40
 Federal Specification QQ-B-691 Composition #2
 Navy " 46-B-23 (ounce metal)
 Army " 57-70 Composition #2

No. 6 metal (casting)

Chemical analysis - 87% copper, 6% tin, 1.6% lead, 4.5% zinc

Recommended for general high pressure steam use up to 400 psi pressure and 500°F. temperature.

Authorities and References:

A.S.T.M. Spec. B-61
 American Foundry Association Table 59 Alloy #1
 S.A.E. Composition #622
 Federal Specification QQ-B-691 Composition #1
 Navy " 46-B-8 Composition M
 Army " 57-70 Composition #1

No. 5 metal (casting)

Chemical analysis - 86% copper, 8% tin, 1.5% lead, 3.5% zinc

Recommended for injector nozzles and bearings.
 It is the same as the following specifications except that the lead content is increased 0.5% for easier machinability.

Authorities and References:

A.S.T.M. Specification B-60
 American Foundry Association Table 73 Alloy #1
 Federal Specification QQ-B-691 Composition #6
 Navy " 46-B-5 Grade 2
 Army " 57-70 Composition #6

3-M----- STANDARD PRACTICE ----- July 7, 1949

Bronze Rod

Chemical analysis - 88% copper, 4% tin, 4% lead, 4% zinc

Recommended for the same uses as #2 metal wherever it is to advantage to use rod.

Authorities and References:

American Brass Co. Alloy #610

Chase Brass and Copper Co. Alloy #444

Nickel Alloy

Chemical analysis - Nickel 32.5%, copper 60.5%, iron 7%.

Recommended for use on steam appliances subjected to high pressures and temperatures. Generally used for valves, valve seats and discs; also for ball joint seats. Satisfactory for use with superheated steam up to 650°F.

Authority and Reference:

International Nickel Co., Spec. Inco #5.

Generally known as "Everbright Metal".

MIXTURE No. 5.	COPPER		TIN	LEAD	ZINC	NICKEL	ALUMINUM	SILICON	MANGANESE	CARBON	IRON	USED FOR
BRONZE No. 2 CASTING	85	5	5	5	5							GENERAL USE-LOW PRESSURE WORK
No. 4	80				20							BRAZING TAILPIECES
BRONZE No. 5 PI CASTING	86.5	8.0	1.5	3.50	MAX. .75							NOZZLES
BRONZE No. 6 CASTING	87.0 87.5	6.0	1.6	4.50	MAX. .75							GENERAL USE-HIGH PRESSURE WORK
NI. ALLOY CASTING	65.0				30.0 32.5			.02	.02	.02	5.0 7.0	SEATS-CHECK VALVES-ETC.
H.P. SOLDER		8	92									HIGH PRESSURE DROP PLUGS
L.P. SOLDER		11	89									LOW PRESSURE DROP PLUGS
ALUM.							95	5				INDUSTRIAL LUBR. BODIES - DELCO SHIELDS -ETC.

CHRIS AHRENS

NATHAN M'FG. CO. NEW YORK

METAL MIXTURES IN USE
JAN. 1947.

5-M-----STANDARD PRACTICE-----July 7, 1949

Threads and Thread Tolerance Standardization

Unless otherwise specified, all threads and thread tolerances shall conform with the specifications as outlined in the following:

National and Acme Threads and Class Fits shall be in accordance with U.S. Screw Thread Standards Handbook issue H28-1944.

Nathan and "V" Threads shall be made to class fits to agree with similar sizes in the National Threads as shown in the U.S. Screw Thread Standards Handbook issue H28-1944.

Whitworth Threads are to be American Truncated Form and shall be made to class fits in accordance with U.S. Screw Thread Standards Handbook issue H28-1944.

National Pipe Threads (taper and straight) and tolerances shall be in accordance with U.S. Screw Standards Handbook issue H28-1944.

British Pipe Threads (straight) and class fits shall be made in accordance with the British Standards Institution issue No. 84-1940.

British Pipe Thread (tapered) and tolerances shall be made in accordance with British Standards Institution issue No. 21-1938. titled Pipe Threads Part one Basic Sizes and Tolerances.

Square Threads do not have standardized tolerances. Thread fits should be established in each instance. It is strongly urged that Acme threads be used in preference to square threads. Where square threads are unavoidable, it is recommended to use the modified form as shown in the U.S. Screw Thread Standards Handbook issue H28-1944.

Wherever classes of fits are used, the class fit number must be designated.

On all existing threads the tolerances must be based on the actual size and not on the nominal size of the thread. This is necessary to maintain interchangeability. Such actual sizes would have to be determined by a survey of parts, tooling or gaging equipment.

S. Shakin
5/31/49

DRAFT

Nathan Thread info

Short instructional note on the Nathan Thread Form

References: (All from Nathan Mfg. files)

Sheet 1038 of 3.1.1939 rev 12.11.1947

The general thread size sheet. The basic pitch diameter has been added to drawing. However, threads were general developed from the Major & Minor diameters of the male and female threads. There is no note of limits (tolerance) on the pitch diameters.

Sketch 1.28.1938

General thread information but specifically referencing 1918 A & B injectors. Shows basic pitch diameters with limits for male & female members. Basic PD is for the thread sizes at the listed threads per inch (TPI)– not all threads/sizes shown.

Sketch 5.5.1942 (11 Simplex “R” NYCRR letter 5-5-42)

Pitch diameter limits for threads used on Nathan No.11 Simplex “R” (used extensively on the NYC) Reference on this Sketch to Dwg. 2774 not included in this information account obsoleted (as same as 1038 less pitch diameter information).

DRG 2774 11.7.1929 rev 9.17.41 obsoleted, superseded by Sheet 1038 10.22.1954 (2774 Not included.)

Standard Coupling Ends: Lubricator, Injectors, Injectors – PRR no date.

Thread diameters m/m & inches – Nathan products – does not include later Nathan products unless thread diameters & TPI are the same.

Standard Practice Page 1 (of 2) of 5.23.1949

General thread Fit – Class #3 – Not specific as to where used.

General information page of 2.16.1949, titled “Recommendations for Thread Class Fits by Mr. J. Brady of the Pratt & Whitney Co.” (In part):

Nathan Thread – In accordance with U.S. Screw Thread Commission Standards shown in issue H28-1944. Copy this issue not in file.

The Nathan thread form is similar to the Injector thread form as recommended by AAR. (It is believed that the Nathan & Sellers thread forms precede the AAR/ARA injector thread practice.)

The additional clearance or truncation of the “V” thread form from the major diameter of the male thread and on minor diameter of the female thread is used primarily used for lubricant and dirt. Thread lubricant used years ago was valve oil mixed with graphite. Roundhouse work areas were not known for their clean conditions.

The later information sheets and references to the thread commission and class of fit indicates that Nathan was bringing their thread form into (then) current thread practices. This would be important as we have not located references for manufacturing of taps & dies or the setting of Nathan Thread gages by the quality control people to check thread sizes of taps, dies and the production of threaded products.

Cont.

MI-SP-7

Even tho, by 11.22.1949, within the company, they were debating about discontinuing use of the Nathan Form on new developments. The Head of Engineering C. F. Ericson in response to a memo from W. Grantham, noted that he was in agreement, but he mentions that it [Nathan form] was already discontinued on new work except where interchangeability was important on the older Nathan products then still in use (our paraphrase of the memo). *(read interchangeable parts old to new)*

As far as generating this thread form, the thread elements are the same as used on the theoretical "V" form as shown on Sheets of 5 Dec 1919 & #1038. It should be noted that excepting the obvious difference from "V" form, that the 'Flats' width from truncating the crest and root are the same Unified/National thread form (TPI/8)

So when generating this thread, the various information sheets will give one an idea of a basic PD and use the differences from the basic male & female PDs and the limits of this portion of the thread elements.

In general, for the 8 & 10 thread Nathan use Pitch Diameter Limits of Female & Male members see Nathan Sketch SK-1.28.38, where the **PD Limits** for the TPI are as follows: This represents a close Class 3 fit on 10TPI with around 0.0025 to 0.0005 clearance.

<u>TPI</u>	<u>Female</u>	<u>Male</u>
10	+0.0015 +0.0005	+000 -0.001
8	+0.001 -000	-0.001 -0.003

Note: What appears to be an unusual same dimension of OD/ID diameters are listed in the Nathan Sk. of 5.5.42 referencing a New York Central letter 57.5.42 concerning 11 Simplex 'R' lifting injectors on lines "D" & "G" where there is but one diameter shown. Why these two threads ^{of 8} were set up in this manner is unknown at this date.

If dealing with worn threads, then be governed accordingly using the minimum allowable clearance to provide the best fit on the worn threads. Since all the limits shown are manufacturing limits, as a recommendation to allow no more than 0.015" total radial clearance between worn male and female members with all other conditions being acceptable for continued service. Re-sizing of threads should be considered before applying new parts to old bodies. Where excessive thread clearance is noted, consider applying oversize part to reduce any possibility of thread being pulled out when tightened or part coming out while under pressure.

C. B. Ahrens – Engineering Office
Rev: Dated 12 July 2010, Rev: 9 Jan 2017

h.T. SP-8

73001

NATHAN MANUFACTURING CO.
ENGINEERING DEPARTMENT

73001

REVISIONS
TOLERANCES

Unless otherwise specified the following tolerances will apply:

Linear dimensions finished surfaces - Fractional inches plus or minus
" " " " - Decimal
" " " " - Millimeters

Diameters finished surfaces - Fractional inches
" " " " - Decimal
" " " " - Millimeters

Squareness - Finished surfaces with axis
Concentricity " " "
Angularity " " "

Rounded surfaces - Finished surfaces in inches
" " " " millimeters
" " " " inches
" " " " millimeters

Flatness - Finished surfaces in inches
" " " " millimeters
" " " " inches
" " " " millimeters

Grade - Class #3 Fit - THREADS

Methods of Dimensioning

Dimensions will not be repeated unless necessary.

Typing - P dimensions will be omitted.

Unless otherwise specified, the following information will apply:

Threads

Depth of tap drills to extend past the thread the equivalent distance 1-1/2 to 2 turns.

Depth of perfect thread will be dimensioned on drawing designation to depth of thread.

Length of perfect male thread will extend within the equivalent of 1-1/2 to 2 turns from the shoulder.

Chamfer end of threads to be 45° and 1.25 times the depth of the three

Pattern

Cast lettering as per Engineering Dept. instruction.

Allowances for finishing surfaces as per shop instruction.

Radii of fillets to be 1/16" unless otherwise specified.

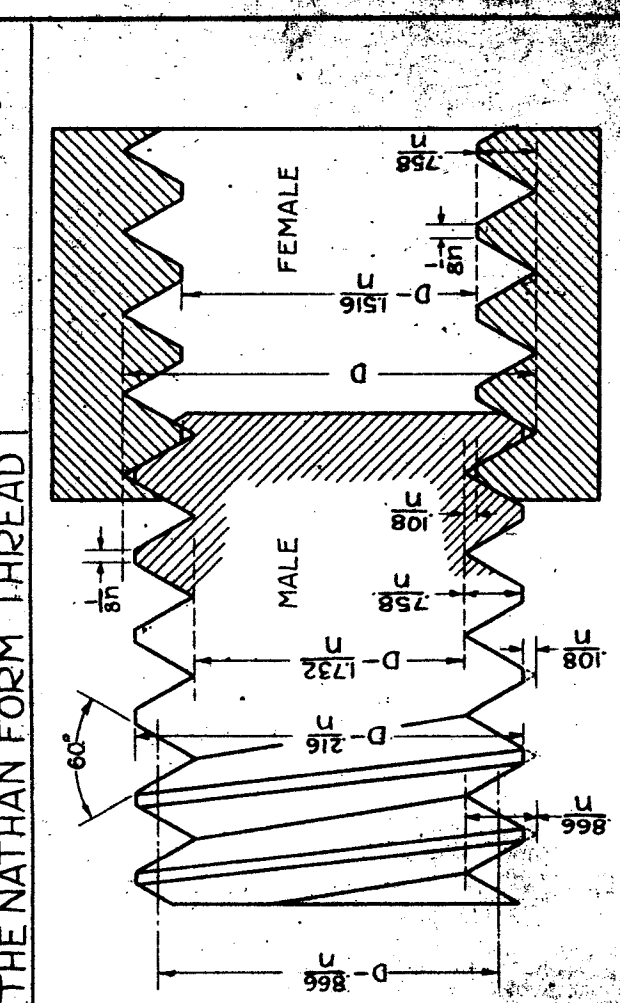
Corners to be rounded up to 1/16" R. maximum unless otherwise specified.

Nathan Mfg. Co. engineering inf
courtesy of Steamtown National H

CERT INFORMATION

DIVISION NO. 1038 DATE MAR 1 1939

REVISIONS APPROVED



D - Nominal diameter.

N - Number of threads per inch.

Column 1 of table indicates number of threads per inch.

Column 2 indicates constant to be subtracted from the nominal D to obtain actual major dia. of male thread.

Column 3 indicates constant to be subtracted from the nominal D to obtain minor diameter of male thread.

Column 4 indicates constant to be subtracted from the nominal D to obtain minor diameter of female thread.

Column 5 indicates constant to be subtracted from the nominal D to obtain pitch dia. of male & female thread.

The pitch diameter for this thread, same as theoretical V form.

Chart applies to above form of thd. only.

1	2	3	4	5
N	216	1732	1516	866
8	.027	2.165	1.894	1.0825
9	.024	1.925	1.684	0.9623
10	.022	1.732	1.516	0.8660
11	.020	1.575	1.378	0.7873
1 1/2	.0188	1.506	1.318	0.7531
12	.018	1.443	1.263	0.7217
13	.0167	1.332	1.166	0.6662
14	.0155	1.233	1.083	0.6186
15	.0144	1.155	1.010	0.5774
16	.0135	1.083	0.947	0.5413
17	.0127	1.019	0.892	0.5094
18	.0120	0.962	0.842	0.4811
19	.0114	0.912	0.798	0.4558
20	.0108	0.866	0.758	0.4330
22	.0098	0.787	0.689	0.3936
24	.0090	0.722	0.631	0.3608
26	.0083	0.666	0.583	0.3331
28	.0077	0.619	0.541	0.3093
30	.0072	0.577	0.505	0.2887
32	.0067	0.541	0.474	0.2706

DEC 1 1947

MT-509

NO 11 SIMPLEX "R" INJECTOR N.Y.C.R.R. ed V-21940-B
THEIR LETTER DATED MAR. 5, 1942

SYMBOL	NOMINAL SIZE & FORM OF TH'D'S.			ACTUAL OUTSIDE DIA. (BASIC, SUBJECT TO LIMITS AS SHOWN)		PITCH DIA. (BASIC, SUBJECT TO LIMITS AS SHOWN)		LIMITS	
	NOMINAL DIA.	THDS PER INCH	FORM OF TH'D'S.	MALE	FEMALE	MALE & FEMALE		MALE	FEMALE
A	31 ³ / ₁₆ "	14	NATHAN	1.205"	1.2205"	1.1586"		+ .000"	+ .002"
B	64 ³ / ₁₆ "	14	NATHAN	2.4934"	2.5088"	2.447"		- .0005"	+ .002"
C	34 ³ / ₁₆ "	18	NATHAN	1.3266"	1.3386"	1.2905"		- .0015"	+ .003"
D	21.56 ³ / ₁₆ "	7	NATIONAL	.849"	.849"	.7561"		- .007"	+ .000"
E	95 ³ / ₁₆ "	14	NATHAN	3.7246"	3.7402"	3.6783"		- .002"	+ .002"
F	100.6 ³ / ₁₆ "	10	NATHAN	3.9386"	3.9606"	3.8740"		- .005"	+ .004"
G	24 ³ / ₁₆ "	2 DBLE	60°	.9449"	.9449"	.8257"		- .007"	- .000"
H	77 ³ / ₁₆ "	14	NATHAN	3.0139"	3.0293"	2.9675"		- .005"	+ .002"
J	40 ³ / ₁₆ "	14	NATHAN	1.5593"	1.5748"	1.5129"		- .002"	+ .001"

NATHAN FORM THREAD SHOWN ON DR'G. 2774

NATHAN M'FG CO. NEW YORK, N.Y.
SK 5-5-42

THREAD FITS

SYMBOL SEE DEG. 962	NOMINAL SIZE & FORM OF TH'D'S.			BASIC FEMALE & MALE	LIMITS		FEMALE MEMBER		MALE MEMBER		REMARKS
	NOMINAL DIA.	THDS PER INCH	FORM OF TH'D'S.		FEMALE	MALE	MAJOR DIA.	MINOR DIA.	MAJOR DIA.	MINOR DIA.	
	A	3"	10		NATHAN	2.950	+ .0015 + .0005	+ .000 - .001	3.0366	2.8850	
B	3 ¹ / ₂ "	10	NATHAN	3.4174	+ .0015 + .0005	+ .000 - .001	3.5040	3.3524	3.4820	3.3308	FOR 1918-B ONLY
C	64 ³ / ₁₆ "	14	NATHAN	2.447	- .001 - .0005	- .0005 - .0015	2.5086 2.5086	2.4004 2.4936	2.4938 2.3854	2.3854 2.3852	FOR 1918-A ONLY
D	77 ³ / ₁₆ "	14	NATHAN	2.9675	+ .001 - .0005	- .0005 - .0015	3.0293 2.9211	2.9214 2.7654	3.0138 2.8592	2.9056 2.7510	FOR 1918-B ONLY
E	40 ³ / ₁₆ "	18	NATHAN	1.528	+ .001 - .0005	- .0005 - .0015	1.5711 1.5761	1.4919	1.5641	1.4799	
F	48 ³ / ₁₆ "	14	NATHAN	1.824	+ .0015 + .0005	+ .000 - .001	1.88586	1.7764 1.7766	1.87036	1.76214 1.76226	
G	36 ³ / ₁₆ "	7	U.S.F.	1.0827	+ .001 - .000	- .004 - .007	1.17556 1.17550	1.0884 1.0899	1.17556 1.17550	1.0884 1.0899	
H	4 ³ / ₈ "	8	NATHAN	1.1417	+ .001 - .000	- .001 - .003	1.24995	1.06055	1.22295	1.03345	

NOTE: NATHAN FORM THREAD SHOWN ON DEG. NO 2774

VALVE FITS

SYMBOL SEE DEG. 962	1918-A				1918-B			
	FEMALE		MALE		FEMALE		MALE	
	DIA.	LIMITS	DIA.	LIMITS	DIA.	LIMITS	DIA.	LIMITS
J	2.008	+ .002 - .002	2.000	+ .000 - .003	2.498	+ .003 - .002	2.490	+ .000 - .003
K	1.968	+ .000 - .005	1.960	+ .003 - .005	1.969	+ .003 - .002	1.961	+ .000 - .003
L	2.510	+ .000 - .002	2.500	+ .000 - .002	2.520	+ .001 - .002	2.512	+ .000 - .003

NATHAN M'FG CO. NEW YORK, N.Y.
SK 1-28-38

MI-SP-10

17

NATHAN THREAD

METHOD OF FINDING ACTUAL DIMENSIONS OF THREAD

EXAMPLE

NOMINAL SIZE 3"-10 NATHAN

MALE MEMBER

AND MAJOR DIA. USE CONSTANT IN COLUMN 2.

$$D - \frac{2165}{\pi} = 3.000 - 0.022 = 2.978"$$

AND MINOR DIA. USE CONSTANT IN COLUMN 3.

$$D - \frac{1.7320}{\pi} = 3.000 - .1732 = 2.827"$$

FEMALE MEMBER

MAJOR DIAMETER EQUALS NOMINAL SIZE

AND MINOR DIA. USE CONSTANT IN COLUMN 4.

$$D - \frac{1.5155}{\pi} = 3.000 - .1516 = 2.8484"$$

WHICH DIAMETER OF MALE & FEMALE MEMBERS.

AND P.D. USE CONSTANT IN COLUMN 5.

$$D - \frac{.8660}{\pi} = 3.000 - .08660 = 2.91340"$$

OF THREADS PER INCH.

EXTRACTED FROM THE NOMINAL "D" DIAMETER OF MALE THREAD

EXTRACTED FROM THE NOMINAL "D" DIAMETER OF FEMALE THREAD

EXTRACTED FROM THE NOMINAL "D" DIAMETER OF MALE AND FEMALE THREAD.

THREAD SAME AS THEORETICAL "V" FORM.

OF THREAD ONLY.

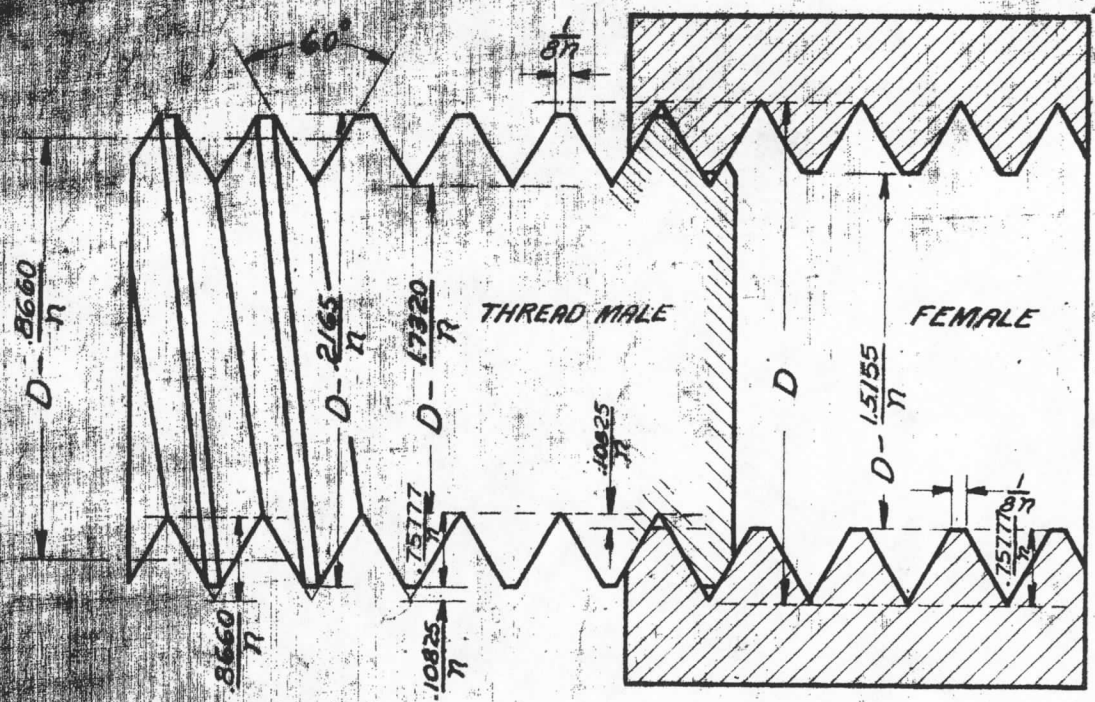
REVISED. 9-17-41.

DRAWING SUPERSEDES DRG. NO 2763 OF 10-5-26.

Obsolete
Superseded by Genl. Insp. Sheet # 1038
revised date 10-22-54

NATHAN M'FG. CO., NEW YORK, N.Y.
FORM OF THREAD
USED ON
NATHAN STD PRODUCTS.
DRG. NO 2774 NOV 7, 1929

M.I.-SP-11



1	2	3	4	5
n	$\frac{2165}{n}$	$\frac{17320}{n}$	$\frac{15155}{n}$	$\frac{8660}{n}$
8	.027	.3165	.1894	.10825
9	.024	.2925	.1689	.09623
10	.022	.2732	.1516	.08660
11	.020	.2575	.1378	.07873
11/2	.0188	.2406	.1263	.07217
12	.018	.2343	.1166	.06662
13	.0167	.2232	.1083	.06186
14	.0155	.2137	.1010	.05774
15	.0144	.2053	.0947	.05413
16	.0135	.1979	.0891	.05099
17	.0127	.1919	.0842	.04811
18	.0120	.1862	.0793	.04558
19	.0114	.1812	.0758	.04330
20	.0108	.1766	.0728	.04136
22	.0098	.1687	.0689	.03936
24	.0090	.1622	.0631	.03608
26	.0083	.1566	.0583	.03331
28	.0077	.1519	.0541	.03093
30	.0072	.1477	.0505	.02887
32	.0067	.1441	.0474	.02706

D = NOMINAL DIAMETER
 n = NUMBER OF THREADS PER INCH
 COLUMN (1) OF TABLE INDICATES NUMBER OF
 COLUMN (2) INDICATES CONSTANT TO BE SUBTRACTED FROM
 TO OBTAIN ACTUAL MAJOR DIAMETER OF
 COLUMN (3) INDICATES CONSTANT TO BE SUBTRACTED FROM
 TO OBTAIN MINOR DIAMETER OF
 COLUMN (4) INDICATES CONSTANT TO BE SUBTRACTED FROM
 TO OBTAIN MINOR DIAMETER OF
 COLUMN (5) INDICATES CONSTANT TO BE SUBTRACTED FROM
 TO OBTAIN PITCH DIAMETER OF
 THE PITCH DIAMETER FOR THIS
 CHART APPLIES TO ABOVE FORM

DRAW THIS

MI-SP-12

Ward Grantham

1/10/63

C. F. Erickson

What is your thinking in re Nathan threads on any new developments?

I feel that we should abandon them entirely except on existing devices where they are now in use.

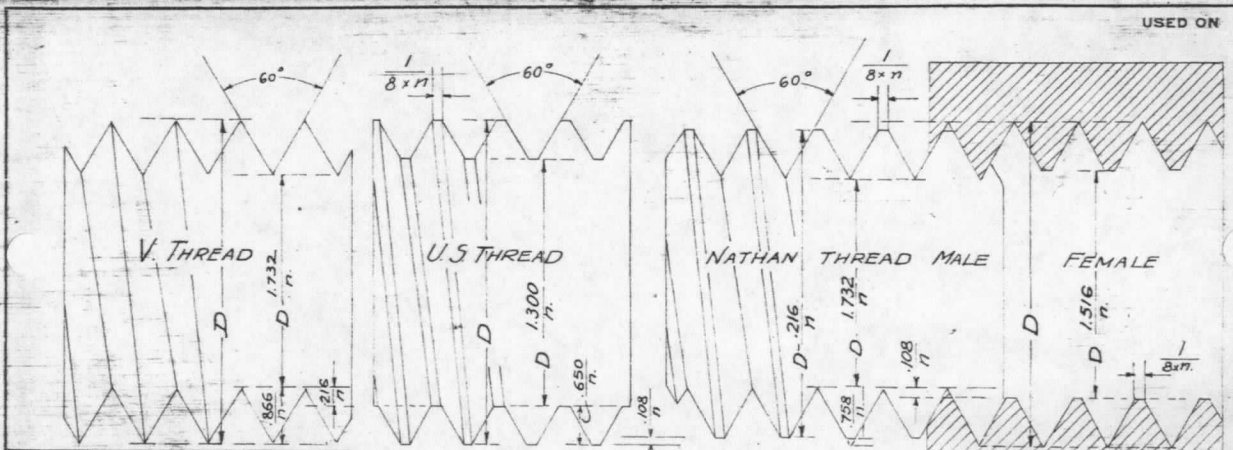
N.B.

do continued past

Agreed - generally they are the correct capability, except in some cases where they are too long.

SS

NATHAN



1	2	3	4	M/M Equiv of Col. 2
17	2 x 108/n	2 x 866/n	2 x 758/n	
8	.027	.2165	.1894	69/100
9	.024	.1924	.1684	61/100
10	.022	.1732	.1516	56/100
11	.020	.1575	.1378	51/100
12	.018	.1443	.1263	46/100
13	.0167	.1332	.1166	42/100
14	.0155	.1236	.1082	39/100
15	.0144	.1154	.1015	37/100
16	.0135	.1083	.0947	34/100
17	.0127	.1018	.0885	32/100
18	.0120	.0962	.0842	30/100
19	.0114	.0912	.0798	29/100
20	.0108	.0866	.0758	27/100
22	.0098	.0787	.0689	24/100
24	.0090	.0722	.0631	23/100
26	.0083	.0666	.0583	21/100
28	.0077	.0619	.0541	20/100
30	.0072	.0577	.0505	18/100
32	.0068	.0541	.0474	17/100
34	.0064	.0511	.0448	16/100
36	.0060	.0481	.0421	15/100

D = Nominal diameter
n = Number of threads per inch

NOTE: Nathan threads may be made with regular V form taps and dies

- Column 1 of table indicates number of threads per inch
- " 2 indicates amount to be subtracted from the nominal diameter "D" to obtain actual outside diameter of male thread
- " 3 indicates amount to be subtracted from nominal diameter "D" to obtain root diameter of male thread
- " 4 indicates amount to subtract from nominal diameter "D" to obtain TAP DRILL diameter.

NOTE ALL DIMENSIONS ARE IN INCHES

Nathan Mfg. Co. engineering information
courtesy of Steamtown National Historic Site

NATHAN M'FG CO. N. Y. GENERAL INFORMATION				
MATL	PAINT	NICKEL	POLISH	DIPPED
SUPERSEDING DRG				
NATHAN THREAD				
DRG	12-5-19			
TRACED				
CHECKED				
APPROVED				

MI-5P-1

13918

MEASUREMENT OVER N^o 7 WIRES 1.05799
 SUBTRACT CONSTANT FOR N^o 7 WIRES .13918
 EQUALS PITCH DIA. OF TAP .91881

NOTE: THE REVERSE PROCESS WOULD BE NECESSARY IF IT WAS REQUIRED TO CONVERT A PITCH DIA. INTO A MICROMETER READING OVER WIRES.

NOTE: FOR PITCHES, CORRECT WIRE, CONSTANTS AND SINGLE DEPTHS OF THREADS SEE TABLE BELOW.

TABLE OF THREAD DIMENSIONS
 FOR USE IN CONVERTING PITCH DIAMETERS INTO
 MICROMETER READINGS (OVER WIRES) BY THE THREE WIRE
 SYSTEM OF MEASUREMENT.

THREADS PER INCH.	PITCH	SIZE CORRECT WIRE	CONSTANT FOR CORRECT WIRE	SINGLE DEPTH U.S. THREAD	SINGLE DEPTH V-THREAD
4	.250000	.043387	.216509	.162379	.276506
5	.200000	.054000	.192449	.129903	.192450
6	.166666	.066666	.173205	.118083	.157459
7	.142857	.082478	.157459	.108253	.144337
8	.125000	.096225	.144338	.092788	.123717
9	.111111	.109150	.123718	.081189	.108253
10	.100000	.123718	.108253	.072768	.096225
11	.090909	.139180	.086602	.064952	.086602
12	.083333	.154545	.078729	.059046	.078729
13	.076923	.171875	.072768	.054127	.072768
14	.071428	.190476	.066617	.049968	.066617
16	.062500	.227273	.054126	.040555	.054126
18	.055555	.272727	.048110	.036096	.048110
19	.052631	.288675	.043301	.034185	.043301
20	.050000	.303030	.039365	.029323	.039365
22	.045454	.333333	.036082	.027063	.036082
24	.041666	.363636	.032075	.024096	.032075
27	.037037	.409091	.028867	.021697	.028867
28	.035714	.428571	.028867	.021697	.028867
30	.033333	.454545	.027063	.020329	.027063
32	.031250	.484848	.025470	.019100	.025470
34	.029411	.515152	.024096	.018096	.024096
36	.027777	.545455	.022903	.017263	.022903
40	.025000	.606061	.021697	.016237	.021697
42	.023809	.642857	.020329	.015361	.020329
44	.022727	.681818	.019100	.014545	.019100
45	.022222	.703704	.018096	.013865	.018096
48	.020833	.769231	.016980	.013227	.016980
50	.020000	.800000	.016037	.012706	.016037
56	.017857	.892857	.014545	.011818	.014545
60	.016666	.969697	.013227	.010909	.013227
63	.015873	1.000000	.012668	.010182	.012668
64	.015625	1.000000	.012668	.010182	.012668
68	.014706	1.000000	.012668	.010182	.012668
72	.013889	1.000000	.012668	.010182	.012668
80	.012500	1.000000	.012668	.010182	.012668

NATHAN M'FG CO. N. Y. GENERAL INFORMATION

MAT'L	PART	WOOD	NET
FINISH	SUPERSEDING OR'G		
DRAWN	4-22-28 J		
TRACED			
CHECKED			

THREAD TABLE
U.S. FORM

M.I.-SP.14

METHOD OF MEASURING WITH THREE WIRES

MICROMETER SHOULD READ CORRECTLY TO .0001 AND MEASURING FACES SHOULD BE FLAT AND PARALLEL.

CONTACT PRESSURE IS OF UTMOST IMPORTANCE. THE PROPER PLACEMENT OF THE WIRES AND THE PROPER "FEEL" WHICH IS SECOND NATURE TO A GOOD THREAD INSPECTOR, ONLY DEVELOPED AFTER PAINSTAKING PRACTICE.

THE DIAMETER OF THE WIRES MUST BE ACCURATE TO .00003" IF IT IS EXPECTED TO MEASURE TO AN ACCURACY OF .0001"

EXAMPLE: TO DETERMINE THE PITCH DIA. OF A $\frac{3}{8}$ "-16 TAP, GIVEN THE MICROMETER MEASUREMENT OVER WIRES AND SIZE OF WIRES:

GIVEN: ACTUAL MEASUREMENT OVER WIRES = .3895

SIZE OF CORRECT WIRE FOR 16 THD = .0360

SOLUTION: BEST WIRE CONSTANT CORRESPONDING TO WIRE SIZE .0360 = .0541

SUBTRACT: ACTUAL MEAS. OVER WIRES = .3895

CONSTANT FOR 16 THREAD = .0541

PITCH DIAMETER

= .3354

THE PITCH DIA. OF THE TAP IS .3354 WHICH IS .0001" LARGER THAN BASIC PITCH DIAMETER. MEASUREMENT OF PITCH DIAMETER BY OTHER THAN "CORRECT" SIZE WIRES.

THE SO-CALLED "CORRECT" WIRE CANNOT BE USED FOR V-THREAD SINCE IT WOULD JUST FILL THE EQUILATERAL TRIANGLE FORMED BY THE THREAD LARGER ANGLE AND WOULD COME FLUSH WITH THE CREST OF THE V-THREAD. CONSEQUENTLY A SLIGHTLY LARGER SIZED WIRE MUST BE USED.

FOLLOWING IS THE RULE FOR DETERMINING PITCH DIAMETER WHEN A DIFFERENT SIZE WIRE IS USED OTHER THAN "CORRECT" WIRE.

RULE:

FIRST: FIND THE DIFFERENCE BETWEEN THE SIZE OF THE "CORRECT" WIRE AND THAT OF THE WIRE PROPOSED TO USE.

SECOND: MULTIPLY THE DIFFERENCE BY THREE.

THIRD: ADD THE RESULT OBTAINED UNDER (TWO) TO THE CONSTANT FOR THE "CORRECT" WIRE. THIS GIVES THE CONSTANT TO USE WITH THE WIRE DESIRED FOR USE.

FOURTH: SUBTRACT THE CONSTANT FOUND UNDER (THREE) FROM MEASUREMENT OVER WIRES.

EXAMPLE: TO DETERMINE THE PITCH DIA. OF A 1"-8 TAP WITH WIRES CORRECT FOR 7 PITCH.

DIAMETER OF NO 7 WIRE .08247

DIAMETER OF NO 8 WIRE -.07216

DIFFERENCE .01031

MULTIPLY DIFFERENCE BY 3 .03093

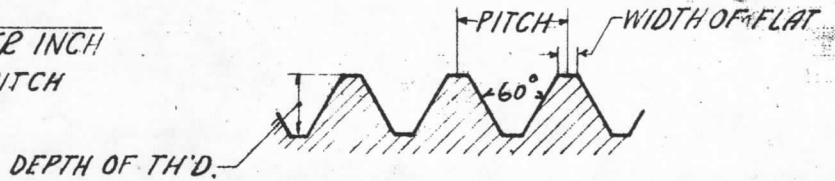
ADD CONSTANT FOR NO 7 WIRE .10825

U.S.S. SCREW THREAD

$$\text{PITCH} = \frac{1}{\text{NO. OF TH'D'S. PER INCH}}$$

$$\text{DEPTH OF TH'D.} = 0.6495 \times \text{PITCH}$$

$$\text{WIDTH OF FLAT} = \frac{\text{PITCH}}{8}$$



DIA.	NO. OF TH'DS. PER INCH	DIA. AT ROOF OF THREAD	DIA. OF TAP DRILL	AREA IN SQ. INCHES		TENSILE STRENGTH AT STRESS OF 6000 POUNDS PER SQ. INCH	WORKING STRENGTH AT STRESS OF 6000 POUNDS PER SQ. INCH	DIMENSION OF NUTS AND BOLT HEADS				
				OF BOLT	AT ROOT OF THREAD							
1/4	20	0.185	13/64	0.049	0.026	160		1/2	0.578	0.707	1/4	1/4
5/16	18	0.240	1/4	0.076	0.045	270		19/32	0.686	0.840	5/16	19/64
3/8	16	0.294	5/16	0.110	0.068	410		11/16	0.794	0.972	3/8	11/32
7/16	14	0.345	23/64	0.150	0.093	560		25/32	0.902	1.105	7/16	25/64
1/2	13	0.400	27/64	0.196	0.126	760		7/8	1.011	1.237	1/2	7/16
9/16	12	0.454	15/32	0.248	0.162	1000		31/32	1.119	1.370	9/16	31/64
5/8	11	0.507	17/32	0.307	0.202	1210	260	1 1/16	1.227	1.502	5/8	17/32
3/4	10	0.620	41/64	0.442	0.302	1810	680	1 1/4	1.444	1.768	3/4	5/8
7/8	9	0.731	3/4	0.601	0.419	2520	1210	1 7/16	1.660	2.033	7/8	23/32
1	8	0.838	55/64	0.785	0.551	3300	1790	1 5/8	1.877	2.298	1	13/16
1 1/8	7	0.939	31/32	0.994	0.694	4160	2470	1 13/16	2.093	2.563	1 1/8	23/32
1 1/4	7	1.064	1 3/32	1.227	0.893	5350	3470	2	2.310	2.828	1 1/4	1
1 3/8	6	1.158	1 7/32	1.485	1.057	6340	4260	2 3/16	2.527	3.093	1 3/8	1 3/32
1 1/2	6	1.283	1 11/32	1.767	1.295	7770	5500	2 3/8	2.743	3.358	1 1/2	1 3/16
1 5/8	5 1/2	1.389	1 27/64	2.074	1.515	9090	6630	2 9/16	2.960	3.623	1 5/8	1 9/32
1 3/4	5	1.490	1 11/32	2.405	1.746	10470	7830	2 3/4	3.176	3.889	1 3/4	1 3/8
1 7/8	5	1.615	1 21/32	2.761	2.051	12300	9470	2 15/16	3.393	4.154	1 7/8	1 15/32
2	4 1/2	1.711	1 49/64	3.142	2.302	13800	10800	3 1/8	3.609	4.419	2	1 9/16
2 1/4	4 1/2	1.961	2 1/64	3.976	3.023	18100	14700	3 1/2	4.043	4.949	2 1/4	1 3/4
2 1/2	4	2.175	2 15/64	4.909	3.719	22300	18500	3 7/8	4.476	5.479	2 1/2	1 15/16
2 3/4	4	2.425	2 31/64	5.940	4.620	27700	23600	4 1/4	4.909	6.010	2 3/4	2 1/8
3	3 1/2	2.629	2 11/16	7.069	5.428	32500	28000	4 5/8	5.342	6.540	3	2 5/16
3 1/4	3 1/2	2.879	2 15/16	8.296	6.510	39000	34100	5	5.775	7.070	3 1/4	2 1/2
3 1/2	3 1/4	3.100	3 11/64	9.621	7.548	45300	40000	5 3/8	6.208	7.600	3 1/2	2 11/16
3 3/4	3	3.317	3 3/8	11.045	8.641	51800	45000	5 3/4	6.641	8.131	3 3/4	2 7/8
4	3	3.567	3 5/8	12.566	9.963	59700	50100	6 1/8	7.074	8.661	4	3 1/16
4 1/4	2 7/8	3.798	3 27/32	14.186	11.340	68000	58000	6 1/2	7.508	9.191	4 1/4	3 1/4
4 1/2	2 3/4	4.028	4 3/32	15.904	12.750	76500	66000	6 7/8	7.941	9.721	4 1/2	3 7/16
4 3/4	2 5/8	4.255	4 5/16	17.721	14.215	85500	74000	7 1/4	8.374	10.252	4 3/4	3 5/8
5	2 1/2	4.480	4 9/16	19.635	15.760	94000	82500	7 5/8	8.807	10.782	5	3 13/16
5 1/4	2 1/2	4.730	4 13/16	21.648	17.570	105500	93000	8	9.240	11.312	5 1/4	4
5 1/2	2 3/8	4.953	5 1/32	23.758	19.260	116000	103000	8 3/8	9.673	11.842	5 1/2	4 3/16
5 3/4	2 3/8	5.203	5 9/32	25.967	21.250	127000	114000	8 3/4	10.106	12.373	5 3/4	4 3/8

M.I.-SR-10

DOUBLE DEPTHS OF THREADS.

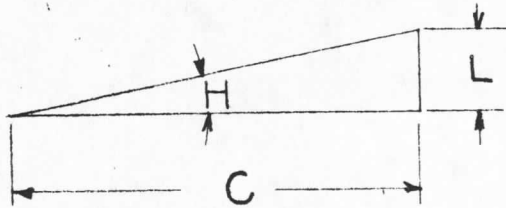
NO. OF THREADS	NATHAN.		U. S. S.		V.		ACME.		WHITWORTH.		90°	
	INCHES.	M.M.	INCHES.	M.M.	INCHES.	M.M.	INCHES.	M.M.	INCHES.	M.M.		
64	.02346	.601	.02029	.515	.02206	.687	.02281	.584	.02200	.568	.01490	
60	.02526	.641	.02165	.549	.02387	.733	.02566	.593	.02333	.627	.01526	
56	.02706	.687	.02319	.589	.03093	.783	.03384	.661	.02283	.679	.01634	
50	.03031	.769	.02598	.659	.03464	.879	.04000	.707	.02567	.630	.01832	
48	.03137	.801	.02706	.687	.03608	.916	.04283	.749	.02667	.677	.01908	
44	.03444	.874	.02932	.749	.03936	.999	.04672	.803	.02909	.738	.02087	
40	.03789	.962	.03247	.824	.04330	1.099	.04990	.861	.03201	.813	.02290	
36	.04209	1.069	.03608	.916	.04817	1.222	.05477	.935	.03556	.903	.02543	
32	.04736	1.202	.04059	1.037	.05413	1.374	.06133	1.034	.04001	1.016	.02862	
30	.05052	1.283	.04330	1.099	.05773	1.466	.06577	1.116	.04268	1.084	.03053	
28	.05412	1.374	.04639	1.178	.06183	1.571	.07079	1.211	.04573	1.161	.03277	
27	.05611	1.425	.04810	1.221	.06413	1.629	.07383	1.269	.04741	1.204	.03372	
26	.05825	1.480	.04996	1.268	.06661	1.691	.07686	1.332	.04925	1.250	.03522	
24	.06314	1.603	.05412	1.374	.07216	1.832	.08166	1.484	.05334	1.353	.03816	
22	.06888	1.749	.05904	1.499	.07872	1.999	.08645	1.662	.05820	1.478	.04263	
20	.07378	1.924	.06495	1.649	.08660	2.199	.09200	1.778	.06480	1.628	.04580	
19	.07975	2.025	.06836	1.736	.09115	2.315	.09763	1.844	.06739	1.711	.04821	
18	.08479	2.138	.07216	1.832	.09622	2.443	.07555	1.918	.07113	1.799	.05088	
16	.09472	2.405	.08118	2.061	.10825	2.749	.08250	2.095	.08003	2.032	.05725	
14	.10818	2.747	.09278	2.356	.12357	3.138	.09142	2.322	.09146	2.323	.06542	
13	.11658	2.961	.09992	2.537	.13233	3.384	.09692	2.461	.09850	2.507	.07045	
12	.12829	3.207	.10825	2.749	.14433	3.665	.10393	2.624	.10671	2.701	.07633	
11	.13778	3.447	.11294	2.869	.15059	3.823	.10699	2.716	.11134	2.828	.07960	
10	.15125	3.499	.11809	2.999	.15745	3.999	.11091	2.817	.11641	2.956	.08327	
9	.16889	3.850	.12990	3.299	.17320	4.399	.12000	3.048	.12806	3.252	.09166	
8	.18947	4.277	.14433	3.665	.19244	4.887	.13111	3.330	.14228	3.613	.10777	
7	.21249	4.811	.16237	4.124	.21650	5.499	.14500	3.682	.16007	4.045	.11440	
6	.23558	5.498	.18555	4.712	.24742	6.284	.16285	4.136	.18992	4.646	.13085	
5	.25258	6.175	.21650	5.498	.28866	7.331	.18666	4.741	.21342	5.420	.15256	
4	.30370	6.998	.23618	5.998	.31490	7.998	.20781	5.255	.23282	5.913	.16652	
3	.33677	7.700	.25980	6.598	.34550	8.811	.22000	5.588	.25612	6.505	.18320	
2	.37889	8.523	.32475	8.248	.38488	9.775	.24222	6.152	.28457	7.228	.20355	
1	.43295	1.0993	.37114	9.426	.49465	12.069	.30477	7.752	.36488	9.293	.26177	
3	.60638	1.2835	.43333	7.1006	.57733	14.656	.35333	8.974	.42686	10.842	.30433	
2	.60620	1.5397	.51960	13.197	.69280	17.597	.42000	10.668	.51226	13.011	.36620	
2	.75775	1.5226	.64950	16.497	.86600	24.998	.52000	13.208	.61033	16.364	.45800	
NO. OF THREADS	INCHES.	M.M.	INCHES.	M.M.	INCHES.	M.M.	INCHES.	M.M.	INCHES.	M.M.	INCHES.	M.M.

NOTES:

TO FIND TAP DRILL DEPTHS, SUBTRACT DEPTH OF THREAD FROM DIA. OF TAP GIVEN.
 EXPRESS DRILL DEPTHS IN DECIMALS OF AN INCH (NOT SMALLER THAN
 OR IN TENTHS OF AN INCH). IN OBTAINING THE NEXT LARGEST OR NEXT
 TO FIND ROOT OF TAP ON HANDLES CUT WITH RATHAN ST. D. TWIN DEPTH
 DOUBLE DEPTH OF TAP FROM DIA. OF TAP.

MEP-11

HELIX ANGLE FOR THREADS



H = HELIX ANGLE.

C = CIRCUMFERENCE AT PITCH DIA. OR P.D. X 3.1416

L = LEAD

FORMULA

$$\text{TAN. } H = \frac{L}{C}$$

EXAMPLE :-

FIND THE HELIX ANGLE OF
1" - 8 TH'DS. NATIONAL.

SOLUTION:-

- 1) FIND THE PITCH DIA.

1.0000	—	O.D.
.0812	—	DEPTH OF ONE TH'D.
P.D. = .9188		
- 2) FIND THE CIRCUMFERENCE AT PITCH DIA.
= 3.1416 X .9188 = 2.8865
- 3) USING FORMULA.

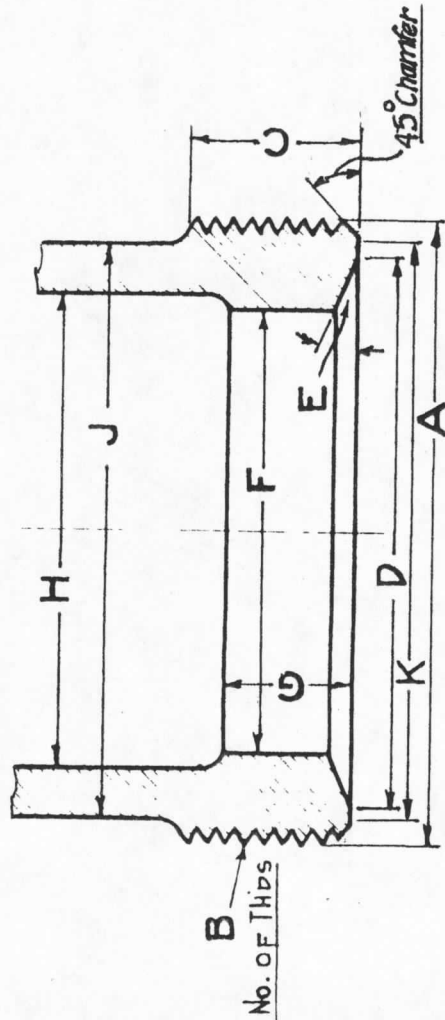
$$\text{TAN. } H = \frac{L}{C} = \frac{.125}{2.8865} = \text{TAN. } .04330" = 2^\circ 29'$$

$$\text{HELIX ANGLE} = 2^\circ 29'$$

STANDARD COUPLING ENDS

INJECTOR CONN. NATHAN STD

NOMINAL SIZE	A		B	C	D	E	F	G	H	J	K
	M/M	INCHES									
3/4	35.2	1.385	11.5	10	30	25°	19	8	23	31	31.8
1	43.8	1.724	11.5	12	39	25°	25.5	10	29	37	40.4
1 1/4	50.4	1.984	10	18	44.5	25°	32	10	36	46	46
1 1/2	60	2.362	10	20	54	25°	38	10	45	55	56
2	71.8	2.826	10	20	65	25°	45	13	48	60	67.5
2	77	3.031	10	23	70	25°	51	15	57	70	72
2 1/2	88.2	3.472	8	25	81	25°	63.5	15	67	80	83
3	100.6	3.96	10	25	94	25°	76	15	80	94	96



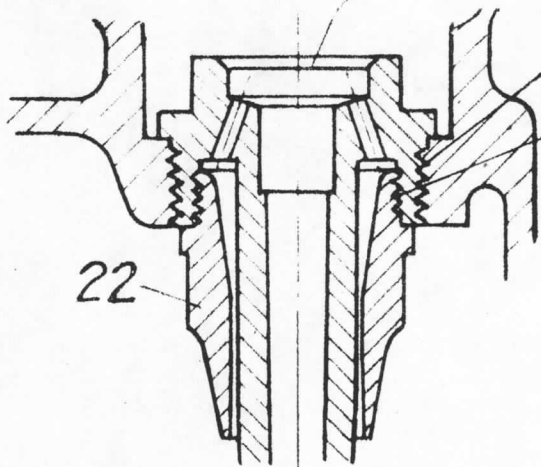
INJECTOR CONN. P.R.R. STD

NOMINAL SIZE	A		B	C	D	E	F	G	H	J	K
	M/M	INCHES									
1/4	53	2.086	10	18	46	25°	32	10	36	46	48.5
1/2	60	2.362	10	20	54	30°	38	10	45	55	56
2	71.8	2.826	10	20	65	30°	45	13	48	60	67.5
2	76.5	3.011	8	23	69.6	30°	51	15	59	72	71.6
2 1/2	87.7	3.452	8	25	81	30°	63.5	15	67	80	82.8
3	105.1	4.137	8	25	98	30°	76	15	80	94	100

LUBRICATOR CONN.

NOMINAL SIZE	A		B	C	D	E	F	G	H	J	K
	M/M	INCHES									
1/8	16.1	.633	18	11	-	-	8	-	-	13	-
1/4	19	.748	18	11	15.5	25°	10	-	-	15	16.8
3/8	23.5	.925	14	12	19	25°	10	6	12	18	20.7
1/2	27.1	1.066	14	12	22.5	25°	13	7	16	22	24.3
3/4	33.4	1.314	14	14	29	25°	19	8	21	28	30.5
1	-	1.687	12	17	34	12°	28	20	29	48	39

MI-391



B) FOR SIZES AND TOLERANCES
OF THREADS SEE TABLE
C) OF FITS - DRG. N° 2495

22

NATHAN MFG. CO. NEW YORK, N.Y.

TABLE OF FITS FOR SCREW CONNECTIONS ON TYPE
"SIMPLEX H.W." NON-LIFTING LOCOMOTIVE INJECTORS
SPECIAL FOR P.R.R.

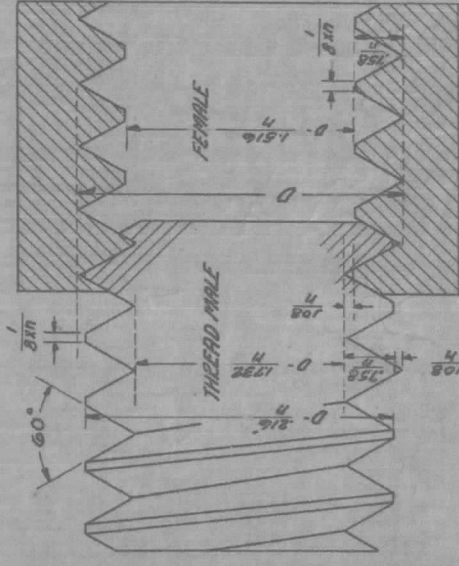
SYMBOLS	ELEMENTS OF FEMALE MEMBERS				ELEMENTS OF MALE MEMBERS				ELEMENTS OF FEMALE MEMBERS				ELEMENTS OF MALE MEMBERS						
	NOMINAL SIZE AND FORM OF THREADS IN INCH. PER INCH.	MINOR DIA. OF FLAT	MINOR DIA. OF FLAT	TOLERANCES ON PITCH DIA.	MAJOR DIA.	PITCH DIA.	MINOR DIA.	MINOR DIA. OF FLAT	TOLERANCES ON PITCH DIA.	MAJOR DIA.	PITCH DIA.	MINOR DIA.	MINOR DIA. OF FLAT	TOLERANCES ON PITCH DIA.	MAJOR DIA.	PITCH DIA.	MINOR DIA.	MINOR DIA. OF FLAT	TOLERANCES ON PITCH DIA.
A	3.031 14	2.157	2.0952	±.002 -.000	3.031	2.9692	2.907	2.833	±.000 -.0015	3.031	2.9444	2.879	2.815	±.0015 -.0000	3.009	2.9444	2.858	2.793	±.0000 -.0015
B	2.157 14	1.843	1.7949	±.002 -.000	2.142	2.0952	1.747	1.7449	±.000 -.0015	1.969	1.9209	1.844	1.789	±.002 -.000	1.957	1.9209	1.872	1.809	±.000 -.002
C	1.843 14	1.299	1.2372	±.002 -.000	1.284	1.2372	1.176	1.1749	±.000 -.002	1.575	1.5132	1.467	1.4089	±.002 -.000	1.560	1.5132	1.452	1.389	±.000 -.002
D	1.299 14	1.102	1.0402	±.002 -.000	1.087	1.0402	979	969	±.000 -.002	1.299	1.2372	1.191	1.1329	±.002 -.000	1.284	1.2372	1.176	1.1129	±.000 -.002
E	1.024 14	1.024	9622	±.002 -.000	1.009	9622	901	8622	±.000 -.002	1.181	1.1192	1.079	1.0209	±.002 -.000	1.166	1.1192	1.058	1.0009	±.000 -.002
F	2.244 14	3.250	3.1634	±.0025 -.0000	2.229	2.1822	2.120	2.089	±.000 -.0025	2.796	2.6942	2.649	2.589	±.002 -.000	2.741	2.6942	2.632	2.573	±.000 -.002
G	3.250 10	1.575	1.5132	±.0025 -.0000	3.228	3.1634	3.077	3.0125	±.000 -.0025	1.929	1.8672	1.821	1.7619	±.0025 -.0000	1.914	1.8672	1.806	1.747	±.000 -.0025
H	1.575 14	1.339	1.2909	±.0025 -.0000	1.327	1.2909	1.243	1.2069	±.000 -.0025	1.850	1.7882	1.742	1.6829	±.0025 -.0000	1.835	1.7882	1.727	1.668	±.000 -.0025
I	945 60°		.8320	±.004 -.000	945	.8320	.728		±.000 -.004	1.339	1.1765	1.044	932	±.004 -.000	1.339	1.1765	1.044	932	±.004 -.000
J	2 1/2 C.P. 8	U.S.F.	3.445	±.003 -.000	3.445	3.3640	3.283	3.207	±.000 -.003	3.445	3.3680	3.287	3.212	±.003 -.000	3.445	3.3640	3.283	3.207	±.000 -.003
K	2.008 18	2.008	1.9599	±.0025 -.0000	1.996	1.9599	1.912	1.869	±.000 -.0025	2.008	1.9599	1.924	1.879	±.0025 -.0000	1.996	1.9599	1.912	1.869	±.000 -.0025
L	1.496 6	U.S.F.	1.496	±.003 -.000	1.496	1.3877	1.244	1.208	±.000 -.003	1.496	1.3877	1.244	1.208	±.003 -.000	1.496	1.3877	1.244	1.208	±.000 -.003
M	2.520 14	2.520	2.4582	±.0025 -.0000	2.505	2.4582	2.396	2.359	±.000 -.0025	2.520	2.4582	2.396	2.359	±.0025 -.0000	2.505	2.4582	2.396	2.359	±.000 -.0025
N	.391 18	.391	.3429	±.0025 -.0000	.379	.3429	.307	.269	±.000 -.0025	.391	.3429	.307	.269	±.0025 -.0000	.391	.3429	.307	.269	±.000 -.0025
O	.689 18	.689	.6409	±.0025 -.0000	.677	.6409	.593	.569	±.000 -.0025	.689	.6409	.605	.569	±.0025 -.0000	.689	.6409	.605	.569	±.000 -.0025
P	.461 18	.461	.4129	±.0025 -.0000	.449	.4129	.365	.365	±.000 -.0025	.461	.4129	.365	.365	±.0025 -.0000	.461	.4129	.365	.365	±.000 -.0025

NOTE: "U" FORM OF THREAD USED ON NATHAN STANDARD PRODUCTS.

FORM OF THREAD ON FEMALE MEMBER.
THE FORM OF THREAD USED ON NATHAN STANDARD PRODUCTS IS SIMILAR IN CONTOUR TO A THEORETICAL "U". THE SIDES OF THE THREAD FORM AN ANGLE OF 60° WITH EACH OTHER. THE NOMINAL SIZE OF THE THREAD PERTAINS TO THE MALE MEMBER OF WHICH THE MAJOR DIAMETER IS A THEORETICAL "U". THE MINOR DIAMETER OF THE FEMALE MEMBER HAS A FLAT TRUNCATED FROM A SHARP "V" TO ONE EIGHTH OF THE PITCH.

FORM OF THREAD ON MALE MEMBER.
THE MAJOR DIAMETER OF THE MALE MEMBER HAS A FLAT WHICH IS TRUNCATED FROM A SHARP "V" EQUAL TO ONE EIGHTH OF THE PITCH. THE MINOR DIAMETER IS A SHARP "V". THE "U" ELEMENTS OF BOTH MALE AND FEMALE MEMBERS ARE MANUFACTURED TO ABOUT ONE TWENTY-FIFTH OF A SHARP "V". THE ERROR CAUSED MAINLY BY THE WEAR OF TAPS AND THREADING DIES.

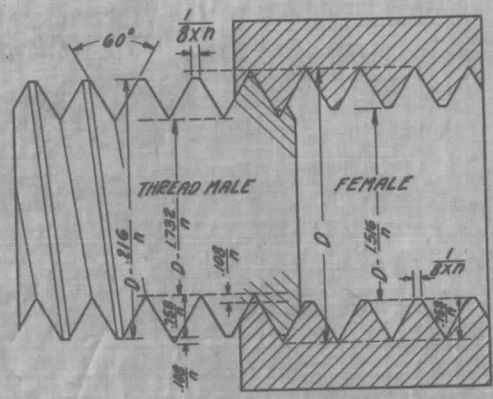
D - NOMINAL DIAMETER
n - NUMBER OF THREADS PER INCH



MI-SP-21

NATHAN M'F'G. CO. NEW YORK
TABLE OF FITS FOR SCREWED CONNECTIONS ON
TYPE "SIMPLEX B.H." LIFTING LOCOMOTIVE INJECTORS
SPECIAL FOR P. R. R.

SYMBOL	No 10										No 11												
	NOMINAL SIZE AND FORM OF THREAD		ELEMENTS OF FEMALE MEMBERS				ELEMENTS OF MALE MEMBERS				NOMINAL SIZE AND FORM OF THREAD		ELEMENTS OF FEMALE MEMBERS				ELEMENTS OF MALE MEMBERS						
	MAJOR DIA. IN INCH.	MINOR DIA. IN INCH.	MAJOR DIA.	PITCH DIA.	MINOR DIA.	WIDTH OF FLAT	TOLERANCES ON PITCH DIA.	MAJOR DIA.	PITCH DIA.	MINOR DIA.	WIDTH OF FLAT	TOLERANCES ON PITCH DIA.	MAJOR DIA.	PITCH DIA.	MINOR DIA.	WIDTH OF FLAT	TOLERANCES ON PITCH DIA.	MAJOR DIA.	PITCH DIA.	MINOR DIA.	WIDTH OF FLAT	TOLERANCES ON PITCH DIA.	
A	2.283	14	2.283	2.2212	2.175	.0089	+001 -000	2.268	2.2212	2.160	.0089	+000 -001	2.520	2.4582	2.412	.0089	+001 -000	2.505	2.4582	2.397	.0089	+000 -001	
B	1.969	14	1.969	1.9072	1.861	.0089	+002 -000	1.954	1.9072	1.846	.0089	+000 -002	2.157	2.0952	2.049	.0089	+002 -000	2.142	2.0952	2.034	.0089	+000 -002	
C	1.575	22	1.575	1.5356	1.506	.0057	+0015 -000	1.565	1.5356	1.497	.0057	+000 -0015	1.843	1.7949	1.759	.0069	+0015 -000	1.831	1.7949	1.747	.0069	+0000 -0015	
D	1.181	18	1.181	1.1329	1.097	.0069	+002 -000	1.169	1.1329	1.085	.0069	+000 -002	1.299	1.2509	1.215	.0069	+002 -000	1.287	1.2509	1.203	.0069	+000 -002	
E	.984	18	.984	.9359	.900	.0069	+002 -000	.972	.9359	.888	.0069	+000 -002	1.102	1.0539	1.018	.0069	+002 -000	1.090	1.0539	1.006	.0069	+000 -002	
F	.866	18	.866	.8179	.782	.0069	+002 -000	.854	.8179	.770	.0069	+000 -002	1.024	.9759	.940	.0069	+002 -000	1.012	.9759	.928	.0069	+000 -002	
G	1.587	18	1.587	1.5389	1.503	.0069	+002 -000	1.575	1.5389	1.491	.0069	+000 -002	2.087	2.0389	2.003	.0069	+002 -000	2.075	2.0389	1.991	.0069	+000 -002	
H	2.520	14	2.520	2.4582	2.412	.0089	+001 -000	2.505	2.4582	2.397	.0089	+000 -001	3.031	2.9692	2.923	.0089	+002 -000	3.016	2.9692	2.908	.0089	+000 -001	
J	1.693	14	1.693	1.6312	1.585	.0089	+0025 -0000	1.678	1.6312	1.570	.0089	+0000 -0025	1.969	1.9072	1.861	.0089	+0035 -0000	1.954	1.9072	1.846	.0089	+0000 -0035	
K	3.425	10	3.425	3.3384	3.274	.0125	+003 -000	3.403	3.3384	3.252	.0125	+000 -003	3.543	3.4348	3.354	.0156	+003 -000	3.516	3.4348	3.327	.0156	+000 -003	
L	1.417	18	1.417	1.3689	1.333	.0069	+002 -000	1.405	1.3689	1.321	.0069	+000 -002	1.870	1.8082	1.762	.0089	+002 -000	1.855	1.8082	1.747	.0089	+000 -002	
M	3.150	14	3.150	3.0882	3.042	.0089	+0025 -0000	3.135	3.0882	3.027	.0089	+0000 -0025	3.740	3.6782	3.632	.0089	+0035 -0000	3.725	3.6782	3.617	.0089	+0000 -0035	
N	3.012	8	3.012	2.9038	2.834	.0156	+003 -000	2.985	2.9038	2.807	.0156	+000 -003	3.453	3.3448	3.264	.0156	+003 -000	3.426	3.3448	3.237	.0156	+000 -003	
O	1.575	14	1.575	1.5132	1.468	.0089	+0025 -0000	1.560	1.5132	1.452	.0089	+0000 -0025	1.575	1.5132	1.468	.0089	+0035 -0000	1.560	1.5132	1.452	.0089	+0000 -0035	
P	3.453	8	3.453	3.3448	3.264	.0156	+003 -000	3.426	3.3448	3.237	.0156	+000 -003	4.138	4.0298	3.949	.0156	+003 -000	4.111	4.0298	3.922	.0156	+000 -003	
Q	1.220	14	1.220	1.1582	1.112	.0089	+0025 -0000	1.205	1.1582	1.097	.0089	+0000 -0025	1.220	1.1582	1.112	.0089	+0035 -0000	1.205	1.1582	1.097	.0089	+0000 -0035	
R	1.213	18	1.213	1.1649	1.129	.0069	+0025 -0000	1.201	1.1649	1.117	.0069	+0000 -0025	1.339	1.2909	1.255	.0069	+0035 -0000	1.327	1.2909	1.243	.0069	+0000 -0035	
S	.849	7	U.S.F. .849	.7562	.663	.0179	+0035 -0000	.849	.7562	.663	.0179	+000 -0035	.849	U.S.F. .849	.7562	.663	.0179	+0035 -0000	.849	.7562	.663	.0179	+000 -0035
T	1.969	14	1.969	1.9072	1.861	.0089	+002 -000	1.954	1.9072	1.846	.0089	+000 -002	2.283	2.2212	2.175	.0089	+002 -000	2.268	2.2212	2.160	.0089	+000 -002	
U	.591	18	.591	.5429	.507	.0069	+003 -000	.579	.5429	.495	.0069	+000 -003	.591	.5429	.507	.0069	+003 -000	.579	.5429	.495	.0069	+000 -003	
V	.945	60°	.945	.8320	.728		+0035 -0000	.945	.8320	.728		+0000 -0035	.945	60°	.8320		+0035 -0000	.945	.8320	.728		+0000 -0035	



D-NOMINAL DIAMETER
 n-NUMBER OF THREADS PER INCH

NOTE:
"V" FORM OF THREAD USED ON NATHAN STANDARD PRODUCTS.
FORM OF THREAD ON FEMALE MEMBER.
 THE FORM OF THREAD USED ON NATHAN STANDARD PRODUCTS IS SIMILAR IN CONTOUR TO A THEORETICAL "V" THE SIDES OF THE THREAD FORM AN ANGLE OF 60° WITH EACH OTHER THE NOMINAL SIZE OF THE THREAD PERTAINS TO THE FEMALE MEMBER OF WHICH THE MAJOR DIA METER IS A THEORETICAL "V" THE MINOR DIAMETER OF THE FEMALE MEMBER HAS A FLAT TRUNCATED FROM A SHARP "V" TO ONE EIGHTH OF THE PITCH.
FORM OF THREAD ON MALE MEMBER
 THE MAJOR DIAMETER OF THE MALE MEMBER HAS A FLAT WHICH IS TRUNCATED FROM A SHARP "V" EQUAL ONE EIGHTH OF THE PITCH. THE MINOR DIAMETER IS A SHARP "V" THE "V" ELEMENTS OF BOTH MALE AND FEMALE MEMBERS ARE MANUFACTURED TO ABOUT ONE TWENTY-FIFTH OF A SHARP "V" THE ERROR CAUSED NAMELY BY THE WEAR OF TAPS AND THREADING DIES.

DE'G. N° 2496 JUNE 8, 1928.

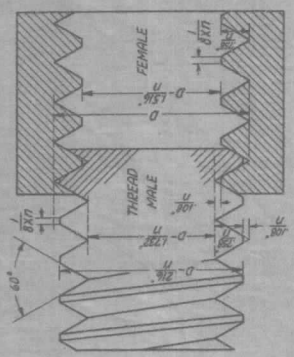
SYMBOL	No 10										No 11											
	NOMINAL SIZE AND FORM OF THREAD		ELEMENTS OF FEMALE MEMBERS				ELEMENTS OF MALE MEMBERS				NOMINAL SIZE AND FORM OF THREAD		ELEMENTS OF FEMALE MEMBERS				ELEMENTS OF MALE MEMBERS					
	MAJOR DIA. IN INCH.	MINOR DIA. IN INCH.	MAJOR DIA.	PITCH DIA.	MINOR DIA.	WIDTH OF FLAT	TOLERANCES ON PITCH DIA.	MAJOR DIA.	PITCH DIA.	MINOR DIA.	WIDTH OF FLAT	TOLERANCES ON PITCH DIA.	MAJOR DIA.	PITCH DIA.	MINOR DIA.	WIDTH OF FLAT	TOLERANCES ON PITCH DIA.	MAJOR DIA.	PITCH DIA.	MINOR DIA.	WIDTH OF FLAT	TOLERANCES ON PITCH DIA.
W	.5146	27	.5146	.4825	.461	.0046	+0015 -0000	.507	.4825	.451	.0046	+0000 -0015	.5146	.4825	.461	.0046	+0015 -0000	.507	.4825	.451	.0046	+0000 -0015
Y	.933	18	.933	.8849	.850	.0069	+0020 -0000	.921	.8849	.837	.0069	+0000 -0020	1.063	1.0149	.976	.0069	+0020 -0000	1.051	1.0149	.967	.0069	+0000 -0020
Z	.298	27	.298	.2659	.250	.0046	+0015 -0000	.290	.2659	.234	.0046	+0000 -0015	.333	.3009	.281	.0046	+0015 -0000	.325	.3009	.263	.0046	+0000 -0015

MI-5P-22

NEW YORK N.Y.
NATHAN MFG CO
TABLE OF FITS FOR SCREW CONNECTIONS ON BULLS EYE LOCKMOUNT LUBRICATORS
SPECIAL FOR P.E.

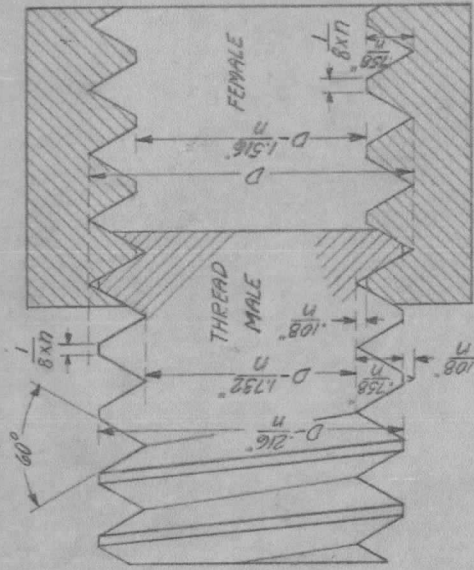
SYMBOL	TYPE 166-106-2 FEED-1 PINT & N8-3 FEED-2 PINTS		TYPE P.P.R.-N9-3 FEED-3 PINTS		TYPE P.P.R.-N9-2 FEED-4 FEED & N9-3 FEED-5 FEED		TYPE 191B-N9-3 FEED-N9-4 FEED & N9-5 FEED-7 FEED		TYPE P-N9-131-5 FEED & N9-151-7 FEED		SYMBOL
	NOMINAL SIZE & THREAD IN INCH	MINOR DIA. INCH	NOMINAL SIZE & THREAD IN INCH	MINOR DIA. INCH	NOMINAL SIZE & THREAD IN INCH	MINOR DIA. INCH	NOMINAL SIZE & THREAD IN INCH	MINOR DIA. INCH	NOMINAL SIZE & THREAD IN INCH	MINOR DIA. INCH	
A	1.637 1/8	1.648	2.008 1/4	2.020	2.370 3/8	2.382	2.702 1/2	2.714	3.034 5/8	3.046	3.407 3/4
B	1.300 1/4	1.312	1.729 3/8	1.741	2.069 1/2	2.081	2.411 5/8	2.423	2.743 3/4	2.755	3.075 7/8
C	1.000 1/4	1.012	1.379 1/4	1.391	1.720 3/8	1.732	2.052 1/2	2.064	2.384 5/8	2.396	2.716 3/4
D	1.000 1/4	1.012	1.379 1/4	1.391	1.720 3/8	1.732	2.052 1/2	2.064	2.384 5/8	2.396	2.716 3/4
E	1.000 1/4	1.012	1.379 1/4	1.391	1.720 3/8	1.732	2.052 1/2	2.064	2.384 5/8	2.396	2.716 3/4
F	1.000 1/4	1.012	1.379 1/4	1.391	1.720 3/8	1.732	2.052 1/2	2.064	2.384 5/8	2.396	2.716 3/4
G	1.000 1/4	1.012	1.379 1/4	1.391	1.720 3/8	1.732	2.052 1/2	2.064	2.384 5/8	2.396	2.716 3/4
H	1.000 1/4	1.012	1.379 1/4	1.391	1.720 3/8	1.732	2.052 1/2	2.064	2.384 5/8	2.396	2.716 3/4
I	1.000 1/4	1.012	1.379 1/4	1.391	1.720 3/8	1.732	2.052 1/2	2.064	2.384 5/8	2.396	2.716 3/4
J	1.000 1/4	1.012	1.379 1/4	1.391	1.720 3/8	1.732	2.052 1/2	2.064	2.384 5/8	2.396	2.716 3/4
K	1.000 1/4	1.012	1.379 1/4	1.391	1.720 3/8	1.732	2.052 1/2	2.064	2.384 5/8	2.396	2.716 3/4
L	1.000 1/4	1.012	1.379 1/4	1.391	1.720 3/8	1.732	2.052 1/2	2.064	2.384 5/8	2.396	2.716 3/4
M	1.000 1/4	1.012	1.379 1/4	1.391	1.720 3/8	1.732	2.052 1/2	2.064	2.384 5/8	2.396	2.716 3/4
N	1.000 1/4	1.012	1.379 1/4	1.391	1.720 3/8	1.732	2.052 1/2	2.064	2.384 5/8	2.396	2.716 3/4
O	1.000 1/4	1.012	1.379 1/4	1.391	1.720 3/8	1.732	2.052 1/2	2.064	2.384 5/8	2.396	2.716 3/4
P	1.000 1/4	1.012	1.379 1/4	1.391	1.720 3/8	1.732	2.052 1/2	2.064	2.384 5/8	2.396	2.716 3/4
Q	1.000 1/4	1.012	1.379 1/4	1.391	1.720 3/8	1.732	2.052 1/2	2.064	2.384 5/8	2.396	2.716 3/4
R	1.000 1/4	1.012	1.379 1/4	1.391	1.720 3/8	1.732	2.052 1/2	2.064	2.384 5/8	2.396	2.716 3/4
S	1.000 1/4	1.012	1.379 1/4	1.391	1.720 3/8	1.732	2.052 1/2	2.064	2.384 5/8	2.396	2.716 3/4
T	1.000 1/4	1.012	1.379 1/4	1.391	1.720 3/8	1.732	2.052 1/2	2.064	2.384 5/8	2.396	2.716 3/4
U	1.000 1/4	1.012	1.379 1/4	1.391	1.720 3/8	1.732	2.052 1/2	2.064	2.384 5/8	2.396	2.716 3/4
V	1.000 1/4	1.012	1.379 1/4	1.391	1.720 3/8	1.732	2.052 1/2	2.064	2.384 5/8	2.396	2.716 3/4
W	1.000 1/4	1.012	1.379 1/4	1.391	1.720 3/8	1.732	2.052 1/2	2.064	2.384 5/8	2.396	2.716 3/4
X	1.000 1/4	1.012	1.379 1/4	1.391	1.720 3/8	1.732	2.052 1/2	2.064	2.384 5/8	2.396	2.716 3/4
Y	1.000 1/4	1.012	1.379 1/4	1.391	1.720 3/8	1.732	2.052 1/2	2.064	2.384 5/8	2.396	2.716 3/4
Z	1.000 1/4	1.012	1.379 1/4	1.391	1.720 3/8	1.732	2.052 1/2	2.064	2.384 5/8	2.396	2.716 3/4
AA	1.000 1/4	1.012	1.379 1/4	1.391	1.720 3/8	1.732	2.052 1/2	2.064	2.384 5/8	2.396	2.716 3/4
BB	1.000 1/4	1.012	1.379 1/4	1.391	1.720 3/8	1.732	2.052 1/2	2.064	2.384 5/8	2.396	2.716 3/4
CC	1.000 1/4	1.012	1.379 1/4	1.391	1.720 3/8	1.732	2.052 1/2	2.064	2.384 5/8	2.396	2.716 3/4
DD	1.000 1/4	1.012	1.379 1/4	1.391	1.720 3/8	1.732	2.052 1/2	2.064	2.384 5/8	2.396	2.716 3/4
EE	1.000 1/4	1.012	1.379 1/4	1.391	1.720 3/8	1.732	2.052 1/2	2.064	2.384 5/8	2.396	2.716 3/4
FF	1.000 1/4	1.012	1.379 1/4	1.391	1.720 3/8	1.732	2.052 1/2	2.064	2.384 5/8	2.396	2.716 3/4
GG	1.000 1/4	1.012	1.379 1/4	1.391	1.720 3/8	1.732	2.052 1/2	2.064	2.384 5/8	2.396	2.716 3/4
HH	1.000 1/4	1.012	1.379 1/4	1.391	1.720 3/8	1.732	2.052 1/2	2.064	2.384 5/8	2.396	2.716 3/4
II	1.000 1/4	1.012	1.379 1/4	1.391	1.720 3/8	1.732	2.052 1/2	2.064	2.384 5/8	2.396	2.716 3/4
JJ	1.000 1/4	1.012	1.379 1/4	1.391	1.720 3/8	1.732	2.052 1/2	2.064	2.384 5/8	2.396	2.716 3/4
KK	1.000 1/4	1.012	1.379 1/4	1.391	1.720 3/8	1.732	2.052 1/2	2.064	2.384 5/8	2.396	2.716 3/4
LL	1.000 1/4	1.012	1.379 1/4	1.391	1.720 3/8	1.732	2.052 1/2	2.064	2.384 5/8	2.396	2.716 3/4

1. FOR N6-146-2 FEED-1 PINT ONLY
2. FOR N8-146-3 FEED-2 PINTS ONLY
3. FOR N9-1-P22-4 FEED ONLY
4. FOR N9-1-P22-5 FEED ONLY
5. FOR N9-1-N9-3 FEED ONLY
6. FOR N9-1-N9-4 FEED & N9-5 FEED ONLY
7. FOR N9-1-N9-7 FEED ONLY
8. FOR N9-1-P-5 FEED ONLY
9. FOR N9-1-P-7 FEED ONLY



NOTE:
 'V' FORM OF THREAD USED ON NATHAN STANDARD PRODUCTS.
 FORM OF THREAD ON MALE MEMBER
 THE FORM OF THREAD USED ON NATHAN STANDARD PRODUCTS IS SIMILAR IN CONTOUR TO A THEORETICAL 'V' THE SIDES OF THREAD FORM AN ANGLE OF 60° WITH EACH OTHER THE NOMINAL SIZE OF THE THEORETICAL 'V' THE MINOR DIAMETER OF WHICH THE MAJOR DIAMETER IS A THEORETICAL 'V' THE MINOR DIAMETER OF THE MALE MEMBER HAS A FLAT TEINICATED FROM A SHARP 'V' TO ONE EIGHTH OF THE PITCH.
 THE MAJOR DIAMETER OF THE MALE MEMBER HAS A FLAT WHICH IS TEINICATED FROM A SHARP 'V' EQUAL TO ONE EIGHTH OF THE PITCH THE MINOR DIAMETER IS A SHARP 'V' THE 'V' ELEMENTS OF BOTH MALE AND FEMALE MEMBERS ARE MANUFACTURED TO ABOUT ONE-TWENTY-FIFTH OF A SHARP 'V' THE ERROR CAUSED NAMELY IN THE WEAR OF THROPS AND THREADING DIES

NATHAN M.F.G. CO. NEW YORK, N.Y.
 TABLE OF FITS FOR SCREWED CONNECTIONS ON BULL'S EYE LOCOMOTIVE LUBRICATORS.
 TYPE 166-2 FEED-2 PINTS AND N931-5 FEED-5 PINTS.
 TYPE 1918-N931-5 FEED-5 PINTS.



D = NOMINAL DIAMETER.
 N = NUMBER OF THREADS PER INCH.

NOTE:

"V" FORM OF THREAD USED ON NATHAN STANDARD PRODUCTS.

FORM OF THREAD ON FEMALE MEMBER.

THE FORM OF THREAD USED ON NATHAN STANDARD PRODUCTS IS SIMILAR IN OUTLINE TO A THEORETICAL "V". THE SIDES OF THE THREAD FORM AN ANGLE OF 60° WITH EACH OTHER. THE NOMINAL SIZE OF THE THREAD PERTAINS TO THE FEMALE MEMBER OF WHICH THE MAJOR DIAMETER IS A THEORETICAL "V". THE MINOR DIAMETER OF THE FEMALE MEMBER HAS A FLAT TRUNCATED FROM A SHARP "V" TO ONE-EIGHTH OF THE PITCH.

FORM OF THREAD ON MALE MEMBER.

THE MAJOR DIAMETER OF THE MALE MEMBER HAS A FLAT WHICH IS TRUNCATED FROM A SHARP "V" EQUAL TO ONE-EIGHTH OF THE PITCH. THE MINOR DIAMETER IS A SHARP "V". THE "V" ELEMENTS OF BOTH MALE AND FEMALE MEMBERS ARE MANUFACTURED TO ABOUT ONE-TWENTY-FIFTH OF A SHARP "V". THE ERROR CAUSED NAMELY BY THE WEAR OF TAPS AND THREADING DIES.

SYMBOL	NOMINAL SIZE & FORM OF THREAD WORKING DIMENSIONS IN INCHES	PITCH DIA. MALE AND FEMALE	FEMALE MEMBER		MALE MEMBER		REMARKS
			MAJOR DIA.	PITCH DIA.	MAJOR DIA.	PITCH DIA.	
A	1.229 18 SEE NOTE	1.8809	1.929	1.845	1.917	1.833	FOR N9 8-166-2 FEED ONLY
B	2.953 14 SEE NOTE	2.8912	2.953	2.845	2.938	2.830	FOR N9 31-166-5 FEED AND FOR N9 31-1918-5 FEED ONLY
C	1.791 14 SEE NOTE	1.7292	1.791	1.683	1.776	1.668	
D	1.866 18 SEE NOTE	1.8179	1.866	1.782	1.854	1.770	
E	1.500 13 U.S.F.	1.4500	1.500	1.400	1.480	1.400	
F	1.063 18 SEE NOTE	1.0149	1.063	1.000	1.051	1.000	
G	1.504 18 V.F.	1.4559	1.504	1.420	1.492	1.408	
H	1.125 18 SEE NOTE	1.0769	1.125	1.041	1.113	1.029	
J	1.067 14 SEE NOTE	1.0052	1.067	1.000	1.052	1.000	
K	1.748 18 SEE NOTE	1.6999	1.748	1.644	1.736	1.652	
L	1.0468 14 U.S.F.	1.0004	1.0468	1.000	1.0468	1.000	
M	1.125 10 U.S.F.	1.0600	1.125	1.000	1.125	1.000	
N	1.500 14 V.F.	1.4382	1.500	1.392	1.485	1.377	
O	1.394 18 SEE NOTE	1.3459	1.394	1.310	1.382	1.298	
P	1.669 18 SEE NOTE	1.6209	1.669	1.585	1.657	1.573	
Q	1.016 18 SEE NOTE	1.0000	1.016	1.000	1.004	1.000	
R	1.461 18 SEE NOTE	1.429	1.461	1.377	1.449	1.365	
S	1.819 14 SEE NOTE	1.7572	1.819	1.711	1.804	1.696	
T	1.260 14 SEE NOTE	1.1982	1.260	1.152	1.245	1.137	
U	1.850 14 SEE NOTE	1.7882	1.850	1.742	1.835	1.727	
V	1.625 12 SEE NOTE	1.5528	1.625	1.499	1.607	1.481	
X	1.375 18 V.F.	1.3429	1.375	1.311	1.375	1.311	
Y	1.634 18 SEE NOTE	1.5859	1.634	1.550	1.622	1.538	
Z	1.870 18 SEE NOTE	1.8219	1.870	1.786	1.858	1.774	
A'	1.625 18 DOUBLE NOTE	1.5528	1.625	1.499	1.607	1.481	
C'	1.315 14 SEE NOTE	1.2592	1.315	1.207	1.300	1.192	
D'	1.625 12 SEE NOTE	1.5528	1.625	1.499	1.607	1.481	
E'	1.584 18 SEE NOTE	1.5359	1.584	1.500	1.572	1.488	
F'	1.650 7 U.S.F.	1.5571	1.650	1.500	1.650	1.500	
F'	1.375 14 U.S.F.	1.3286	1.375	1.282	1.375	1.282	
G'	1.791 14 V.F.	1.7292	1.791	1.668	1.791	1.668	

MI-SPRW