

MSG N#- 28370 FR-ELB TO-PCQA SENT-07/26/91 01:30 PM
R#-167 ST-C DIV-0050 CC-00101 BY-ELB AT-07/26/91 01:30 PM

JULY 26, 1991

TO:	RUSTY STRUBLE	RCS2	CC:	TOM CHARBONEAU	TC
	MIKE DeMATTIA	PCQA		JOHN KOURTESIS	NDES
	CHARLIE DOUGLAS	CPFC		STEVE MAJOR	NHLE
	DICK GARIOPY	NFFC		ANDY McGUIRK	PCQA
	PAUL KOTCH	PRK1		ED O'NEILL	EJON
	JOS LAHARE	JNL6		JOE SCHUCK	NHLE
	STEVE OFFILER	SBO1		GARY SNYDER	CPFC
	MATT SELLERS	PCME		MARTHA SULLIVAN	CPFC
	BILL SWEET	PCME		RAY TOURANGEAU	PCME
	JIM WATT	PCQA		TED BALLARD	AVHE
	TED BREDIKEN	PSNT		STAN BOMOL	SN2
				CLAIRE BALTAZAR	PSNT
				BILL CONGDON	NFFC
				STEVE MCCOONY	NDES
				TERRY RODRIGUEZ	NFFC
				DONNA MOYNIHAN	PCQA
				PAUL WESTERLIND	B511

FR: DAVE CHARN HARN

SJ: FORD CRUISE CONTROL PRESSURE SWITCH START-UP MEETING
RESCHEDULE

THE NEXT MEETING SCHEDULED FOR 8/1 AT 10AM IN THE MARKETING CONF.
ROOM HAS BEEN RESCHEDULED AS FOLLOWS:

DATE: 08/08 (THURSDAY)
TIME: 10:00 - 11:30 AM
PLACE: MARKETING CONFERENCE ROOM

REGARDS,
DAVE CHARN 32A-FORD

✓
McK
Thursday
Yolk to Clean
to when can Bob
+ Q go over to
see equipment.

✓
Cooling Spec for 77PS
Check QAS.

TI-NHTSA 002206

-MSG N#- 12528 FR=CERN TO=PCQA SENT=07/26/91 07:50 AM
R#-146 ST=C DIV=0050 CC=00101 BY=CERN AT=07/26/91 07:50 AM

JULY 26, 1991

TO: RUSTY STRUBLE	RC52	CC: TON CHARBONEAU	TC
MIKE DeMATTIA	PCQA	JOHN KOUTESIS	NDES
CHARLIE DOUGLAS	CPFC	STEVE MAJOR	WELZ
DICK GARIBPY	MPFC	ANDY McGUIRK	PCQA
PAUL KOTCH	PRK1	ED O'NEILL	BJON
JOE LAZARE	JHL8	JOE SCHUCK	WELZ
STEVE OFFILER	SB01	GARY SNYDER	CPFC
MATT SELLERS	PCNE	MARTHA SULLIVAN	CPFC
BILL SWEET	PCNE	RAY TOURANGEAU	PCNE
<u>JIM WATT</u>	PCQA	TED BALLARD	AVNE
TED BREDIKEN	PSWT	STAN BONOL	SHZ
		CLAIRE BALPHEASAR	PSWT
		BILL CONGDON	MPFC
		STEVE MCCOON	NDES
		TERRY RODRIGUEZ	MPFC
		DONNA MOYNIHAN	PCQA
		PAUL WESTERLIND	BS11

FR: DAVE CERN EARN

SJ: FORD CRUISE CONTROL PRESSURE SWITCH START-UP MEETING:
07/25/91 MEETING MINUTES

MEETING

THE NEXT MEETING IS SCHEDULED FOR:

DATE: 08/01 (THURSDAY)
TIME: 10:00 - 11:30 AM
PLACE: MARKETING CONFERENCE ROOM

MCR

PLEASE CALL ME IF YOU ARE NOT ABLE TO ATTEND

* = ITEMS THAT ARE NEW OR HAVE BEEN REVISED OR COMPLETED
SINCE PREVIOUS MEETING

57 L/T (L3-2)

WHO WHEN

Export:

- * REPORT ON ELCO ISSUES FROM 7/22 VISIT
- 10B21 STEEL/.00015" MIN. PLATE/J512 3/
THREAD CHANF. ANGLE/THREAD CAP
- * REVISED EXPORT PRINT W/ RADIUS
ON DOGPOINT DIAMETER

KOTCH	ONGOING		
OFFILER	07/11	ORIG.	
	08/00	REV.	

ISR issues:

- . RELEASE PRINT FROM L/T
- . SUBMIT ISR FOLLOW-UP TO FORD SQA
(NEED RELEASE PRINT)

SCHUCK	05/09	ORIG.	
	08/01	REV.	
WATT	06/08	ORIG	
	08/03	REV.	<i>Complete</i>

57 P/C (L3-3)

Environmental Seal:

- * DETERMINE BEST WAY TO DIFFERENTIATE

SELLERS	08/00
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TI-NHTSA 002207

- P/C AND L/T ENV. SEALS (COLOR, STRIPES...)
 * DEFINE GAGING TORQUE (In Spec. 6102
 SPEC W/J. HUTCHISON (PITTS)

WATT 06/20
 Complete 08/08

ORIG Production Validation
 REV. on new Gasket

77PS

77PS 41
 Base P/C
 4/5/15

Get new
 parts list
 on 77PS
 next week

Q101
 on fabrication
 for validation
 test

LD-77K
 Aug 26

- PROD. LINE SET-UP (RTE CARDS, ETC) BALTHAZAR ONGOING
- UPDATE PRODUCTION PLANS FOR ALL SWITCHES DOUGLAS ONGOING
- REVIEW 77PS S/O TIMING WITH PURCHASING DOUGLAS 08/01
- 77PS B/S PARTS LISTS OFFILER 08/06
- COMPLETE DESIGN FMEA OFFILER 08/01
- COMPLETE PROCESS FMEA OFFILER 04/18
- IS CALIBRATION ACCURACY ACCEPTABLE OFFILER/ 07/31
- W.R.T. DEVICE PERFORM. AND MFG. YLDS ? SELLERS 07/01
- 77PS DESIGN CONFIRMATION TEST OFFILER 07/31
- PROD'N CALIBRATION WINDOW EXPERIMENT OFFILER 08/08
- W/ "SILENT" SENSORS SELLERS
- MFG. TO REVIEW ARM GAGING TECHNIQUE SELLERS/ 06/20
- COMPLETE B.A.M. STAKER MODIFICATION MCCOONEY 08/08
- 57 TO 77 CONVERSION: PHASE 1 TESTING HOMOL 07/04
- HOLD SEPARATE WEEKLY MFG. START-UP MTGS. SELLERS 07/18

ORIG.
 REV.
 ORIG.
 REV.
 ORIG.
 REV.

ORIG.
 REV.
 ORIG.
 REV.
 COMP.

ORIG.
 REV.

2A Items:

- 77PS GAS (FINAL) (100% & 100% type) WATT 08/01
- 77PS CHARACTERISTIC SHEETS - 100% type WATT 07/18
- GAGE R&R STUDIES 57PS R&R Gage 100% type WATT 08/08
- 10KPSI GAGE FOR BURST TESTER WATT 07/15
- SCHED. TO COMPLETE QC P-TESTER WATT 08/03
- IDENTIFY ANY OTHER ITEMS THAT NEED TO BE COMPLETED FOR 9/10 IIR SUBMISSION WATT 08/01

ORIG.
 REV.
 ORIG.
 REV.

IV Testing:

- COMPLETE TESTING AND REPORT Give Bob OFFILER 09/16
- Device based on Amplush. Copy of spec. P/C OFFILER 09/20

ORIG.
 REV.

Production Components:

- RESOLVE OPEN ISSUES ON BASE (PUSHOUT DUE TO STAKER EVAL.) SELLERS 04/11
- PROPOSAL FOR RECEIVING GASKETS ON MANDRELS SELLERS 08/09
- INVESTIGATE C.R. IDEAS FOR ENV. SEALS ON MANDRELS (...REUSABLE MANDRELS, ETC.) SELLERS 07/11
- EXPEDITE LOT OF ENV. SEALS ON MANDRELS WESTERL. 07/25
- SORT EX355-97 GASKETS (ROUNDNESS) BALTHAZAR 07/25

ORIG.
 REV.
 ORIG.
 REV.
 COMP.

Manufacturing Equipment:

- FINAL ASM MACHINE DEBUG COMPLETION SELLERS/ 06/03
- BASE ASM MACHINE BUILD COMPLETION KOURTESIS 08/02

ORIG.
 REV.
 ORIG.
 REV.

. PRESSURE TESTER BUILD COMPLETION	SELLERS/ 06/20	ORIG.
	KOURTESIS 08/02	REV.
. ESTABLISH CRITERIA FOR EFFECT. RUNS	SELLERS 07/25	ORIG.
	08/01	REV.
. B.A.N. EFFECTIVITY RUN #1	SELLERS 07/03	ORIG.
	08/02	REV.
. F.A.N. EFFECTIVITY RUN #1	SELLERS 07/03	ORIG.
	08/02	REV.
. EQUIP. MOVE TO B12	SELLERS 09/12	

TOKICO:

. REPORT ON TOKICO P.S.	DOUGLAS	ONGOING
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DISCUSSION

ADDER FOR GASKETS ON MANDREL IS \$1/K; REQUIREMENT WILL BE NOTED ON PRINT. ADDER FOR THE ENVIRONMENTAL SEAL IS \$3/K (38% COST INCREASE). MATT/PAUL W. TO INVESTIGATE WAYS TO REDUCE COST BEFORE ADDING TO PRINT.

WE ARE ASSUMING THE USE OF THE THICKER ENVIRONMENTAL SEAL FOR P/C SWITCHES FOR 77PS PRODUCTION. MATT WILL INVESTIGATE WAYS TO DIFFERENTIATE FROM THE L/T SEAL.

77PS VALIDATION TESTING HAS BEGUN ON BOTH P/C AND L/T SWITCHES. ISR SUBMISSION IS STILL TARGETED FOR 09/20.

THE PRODUCTION PLAN HAS BEEN REVISED AS SHOWN BELOW. AUGUST BUILD WILL SUPPORT RELEASES THROUGH EARLY OCTOBER; NO PROD'N IS PLANNED DURING SEPTEMBER, AS THE EQUIPMENT WILL BE MOVED TO B12 DURING THIS TIME.

MILESTONES	PLANNED	ACTUAL
57 L/T ISIR	11/21/90	11/21/90
57 L/T JOB 1	09/03/91	
57 P/C ISIR	01/15/91	01/15/91
57 P/C JOB 1	06/03/91	
77PS ISIR	09/01/91 ORIG.	
	09/20/91 REV.	
77PS SOP (TI) est.	08/91	

PRODUCTION PLAN BY MONTH (THOUSANDS) - WITHOUT OVERAGE

	P/C 57PSL5-3	L/T 57PSL5-2	P/C 77PSL2-1	L/T 77PSL2-3
APR	0	0	0	0
MAY	2 (COMP.)	2	0	0
JUN	0	0	0	0
JUL	0	2.3	0	0
AUG	0	2.3	10	20
SEP	10	2.0	0	0
OCT	0	0	* 9 ?	* 12.5
NOV	0	0	25 ?	12.5
DEC	0	0	25 ?	12.5

* = TENTATIVE JOB1 FOR 77PS VERSIONS

*Oct 77PS
P/C + L/T
25K 7K*

REGARDS,
DAVE CERN \52-FORD

TI-NHTSA 002210

-MSG #=- 28370 FR-ELB TO-PCQA SENT-07/26/91 01:30 PM
RF-168 ST-C DIV-0050 CC-00101 BY-ELB AT-07/26/91 01:30 PM

JULY 26, 1991

TO:	RUSTY STRUBLE	RCS2	CC:	TOM CHARBONNEAU	TC
	MIKE DeMATTIA	PCQA		JOHN KOURTESIS	NDRS
	CHARLIE DOUGLAS	CPFC		STEVE MAJOR	WELS
	DICK GARIFFY	MFPC		ANDY McGUIRE	PCQA
	PAUL KOTCH	PRK1		ED O'NEILL	EJON
	JOE LAZARE	JHL8		JOE SCHUCK	WELS
	STEVE OFFILER	SE01		GARY SNYDER	CPFC
	MATT SELLERS	PCNE		MARTHA SULLIVAN	CPFC
	BILL SWEET	PCNE		RAY TOURANGEAU	PCNE
	JIM WATT	PCQA		TED BALLARD	AVNE
	TED BREDIKEN	PSWT		STAN HONOL	SEI
				CLAIRE BALCHAKAR	PSWT
				BILL CONGDON	MFPC
				STEVE HOGGOKY	NDRS
				TERRY RODRIGUES	MFPC
				DOMENICA NOTYHEAN	PCQA
				PAUL WESTERLIND	B511

FR: DAVE CERN EARN

SJ: FORD CRUISE CONTROL PRESSURE SWITCH START-UP MEETING
RESCHEDULE

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TIME: 10:00 - 11:30 AM
PLACE: MARKETING CONFERENCE ROOM

REGARDS,
DAVE CERN 132A-FORD

Blue grab on 77A3.

VX-54 spec from Andy
on turn position

TI-NHTSA 002211

HIGHLIGHTS
Stephen B. Offler
Week Ending 91-07-26

Handwritten: 910726



FORD MY'92 ELECTRONIC SPEED CONTROL DEACTIVATE PS

VALIDATION:

We completed build of roughly 100+ each of Pass Car and Light Truck 77PS, from which we are taking the required quantity of validation parts (72/each). Jeff completed an initial characterization of 50/each, discovering 0 bad for PC and 4 bad (8%) for LT. The four LT parts were diagnosed to be over-calibrated, such that the pin was effectively too short. This seems to be the more common calibration problem - we've yet to see any under-calibrated. The problem may be related to excessive spring angle, which requires undue force to keep the contacts closed during calibration: without the contacts closed, the calibrator gets erroneous feedback from the LVDT, and basically crushes the stationary terminal. We have the ability to add force to the calibrator if needed to improve its yields, and furthermore the check station (once operational) will catch these bad parts before they get built into devices. Additionally, note that all of these parts were calibrated based on the results of the production piloting technique experiment. 100% of the parts which were calibrated properly produced good devices, adding confidence to this technique. Jeff is presently handling all of the issues related to co-ordination of validation testing, and is on track to deliver Fluid Resistance parts to the Chem Lab on Monday, 910729.

CUSTOMER ISSUES:

A minor modification to the Insertion Force Test report was made, to include information on force versus insertion position. This shows how far the connector has been inserted when the peak force occurs, and what level of force is maintained at full installation. These revised reports were hand-delivered by Joe Schuck and well received. John Polkey will now approve our proposed modification to the terminal position tolerance, to 0.25mm.

Efforts on the 77PS FMEA (Design and Process) have begun. The latest version of the "Fail-safe" software, V1.11, is being employed. We have a Ford-specific copy, with their column headings and help screens oriented towards Ford's FMEA philosophy. Jim Cosmas at Kelsey-Hayes had requested we complete this effort by August 1, but with the difficulty we had in getting started and vacation schedules this date will slip. I contacted Jim to understand why he needs it by 8/1. He informed me that the pressure switch failure they experienced on their submersion test has highlighted the need for the FMEA information (even though our analysis showed the mating connector was at fault). Jim understands that we won't be ready for 8/1, and indicates that he needs the information as soon as it is feasible for us. We will make every effort to complete this and get it to K-H by the second week of August.

MECHANIZATION:

During the validation build, we discovered the difficulties with the environmental seal feed station were directly related to the out-of-roundness condition of the seals. They are packed tightly in plastic bags, which tends to distort them. To build validation parts, we manually sorted through a bag containing 4K seals to obtain a couple hundred which were still round. These fed quite well. Matt, Claire, and I visited the warehouse to research the issue, and discovered that the seals come in from JBL packed loosely in a box, and we actually stuff them tightly into bags for kitting purposes. We have requested that this process stop, and gaskets issue on-demand instead. We will need to make this change official.

TI-NHTSA 002212

HIGHLIGHTS 910726

Page 2

Wayne Carlson reports that he is making good progress with the check station software, and gave me a quick demo this week. I have asked him to set aside a bagful of parts once he has it completed, along with printouts of the calibrator and check station dimensions. We will then check these using Jeff's manual technique to develop a correlation.

Andre Charpentier has run a lot of 20 77's through the pressure washer, printed results, and delivered the parts back to us to be manually checked. We will have this data available later today.

Eastern Automation personnel visited for two days this week, and Milford rivet people were brought in at the same time, to get the movable terminal equipment running acceptably. They've made good progress, with a fairly low percentage (2.5%) of rivet misfeeds. We will continue to work on this issue. Dave Peripoli has noted that the Thompson riveter used for this same rivet (74171) has a different driver geometry, and will experiment with this. The spring angle is still an issue, but not easily correctable. Our next step is to determine if the present angles are acceptable. On a positive note, the consistency of the angle is presently quite good.

July 29, 1991

To: Donna Moynihan 12-27

From: Beth Kill 10-16

Subject: GP-3 Material Confirmation
TSL Request # 110831

Sample Description:

#110831	P/N 74353-1	Gasket	Ethylene propylene rubber
---------	-------------	--------	------------------------------

Results:

Akron Rubber Development Laboratory Inc. has analyzed the above component. The material conforms to specification. See the enclosed report.

Regards,

Beth X3069

TI-NHTSA 002214



AKRON RUBBER DEVELOPMENT LABORATORY, INC.

300 MEMORIE BOULEVARD • AKRON, OHIO 44304
Office (216) 434-6664 Telex (216) 434-6664

July 24, 1981

Ms. Elisabeth Hill
Texas Instruments
34 Forest St.
MS 10-16
Attleboro, MA 02703

SUBJECT: Chemical analysis on sample submitted by the above company.
PO# 800084978

RECEIVED: One sample identified as; #110831 Ethylene Propylene JEL compound
E-7104-70.

ANALYSIS IDENTIFICATION NUMBER E-2472
Pyrolysis method

SAMPLE

#110831

ANALYSIS IDENTIFICATION

Ethylene-Propylene Rubber

Jo Seifert
Jo Seifert
Senior Chemical Technician
AKRON RUBBER DEVELOPMENT LABORATORY, INC.

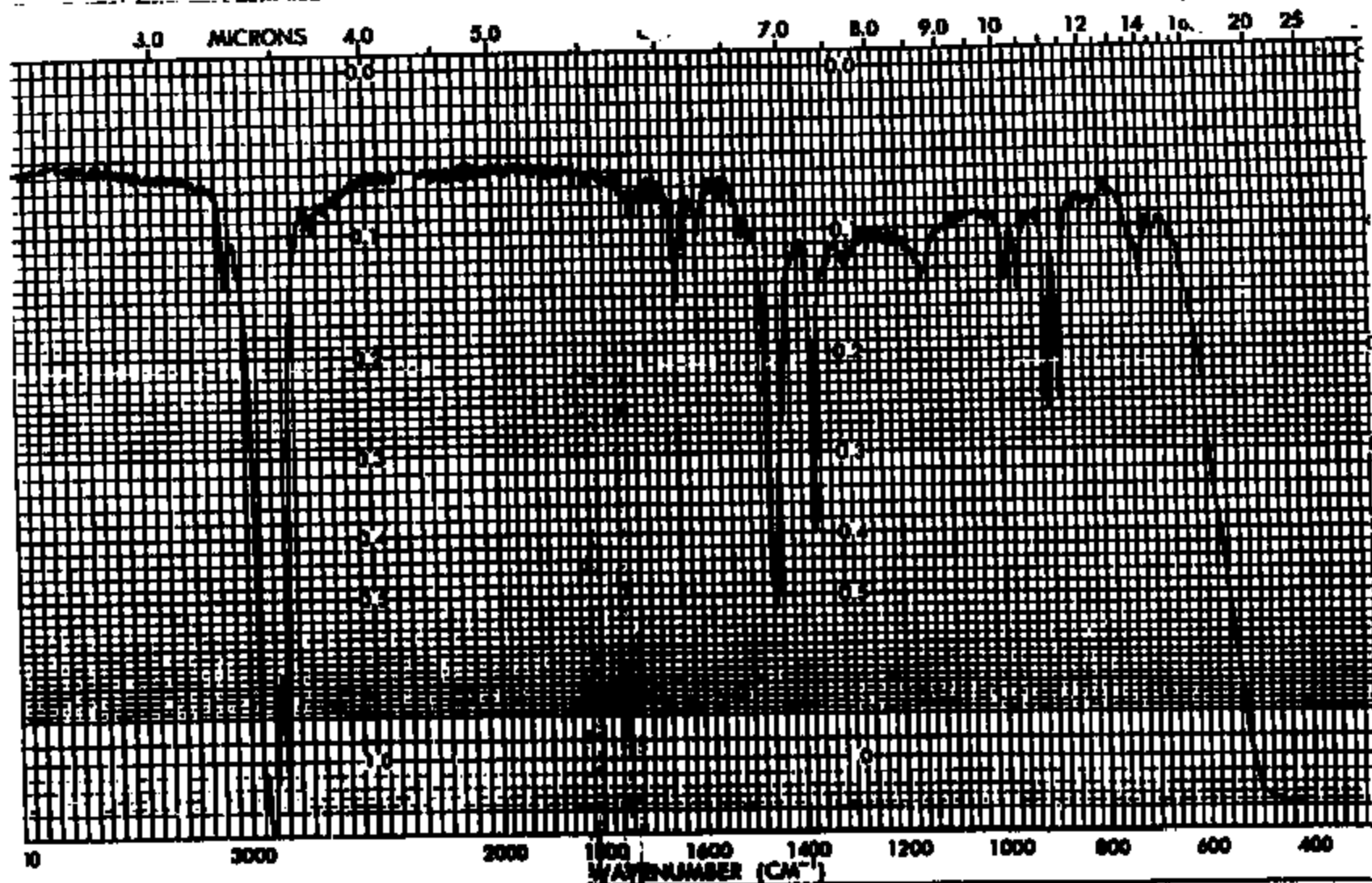
Thomas M. Kowles
Thomas M. Kowles
Vice President, Chemical Services

PN# 11724

INV# 31172601

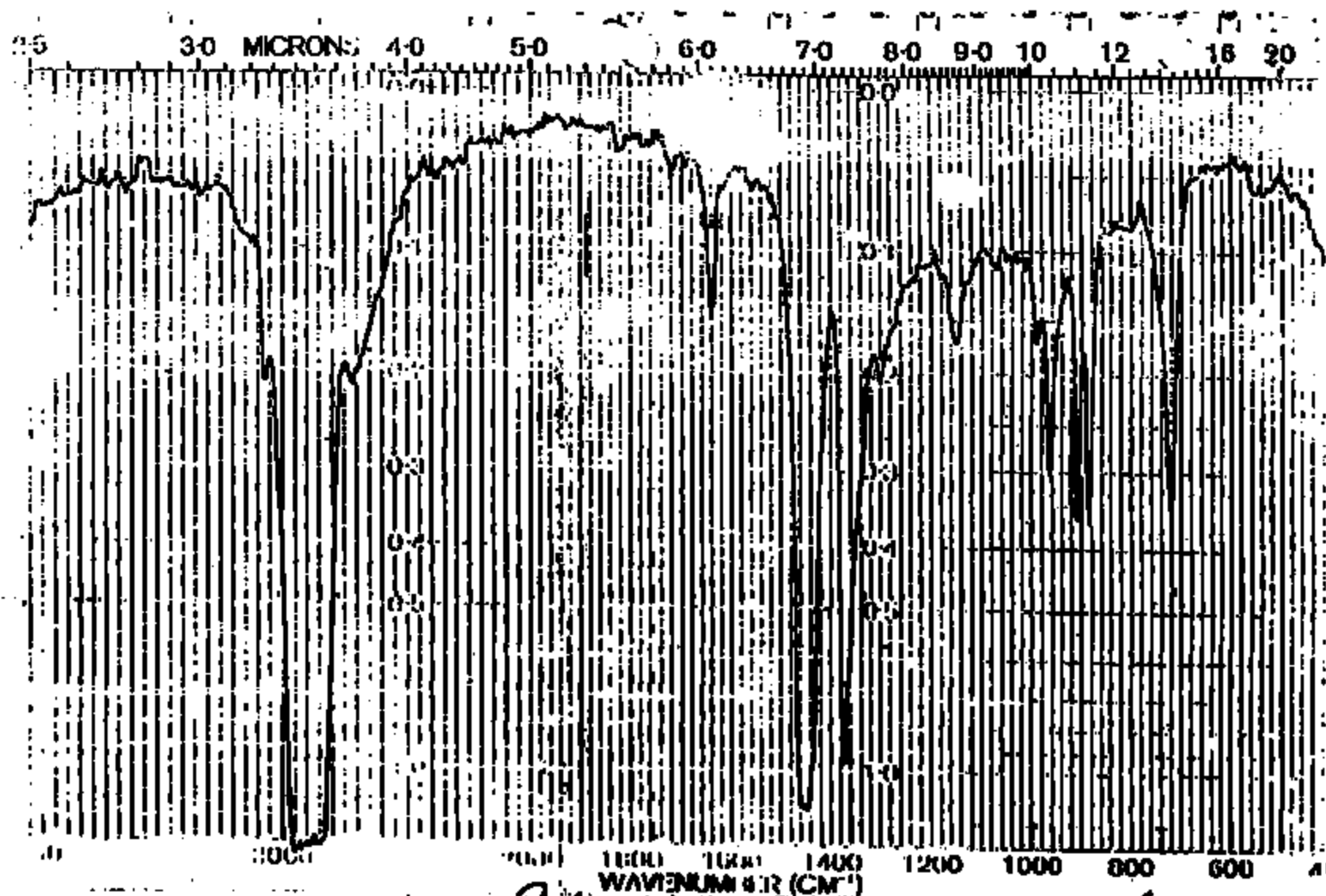
TX

TI-NHTSA 002215



AMPLITUDE	SOLVENT	WAVELENGTH	SINGLE B.	REMARKS
	CONC.	REF.	T. D. SPEED	
	CELL PATH	OPERATOR	QSD. EXP.	
	REFERENCE	DATE	T. CONST.	
WAVENUMBER	No. 98 5100-1001		REV. No.	

TI-NHTSA 002216



ETHYLENE PROPYLENE RUBBER

PREPARED BY
DATE
ANALYST
LABORATORY

SCAN 5
FILE 2
NAME Tan
DATE

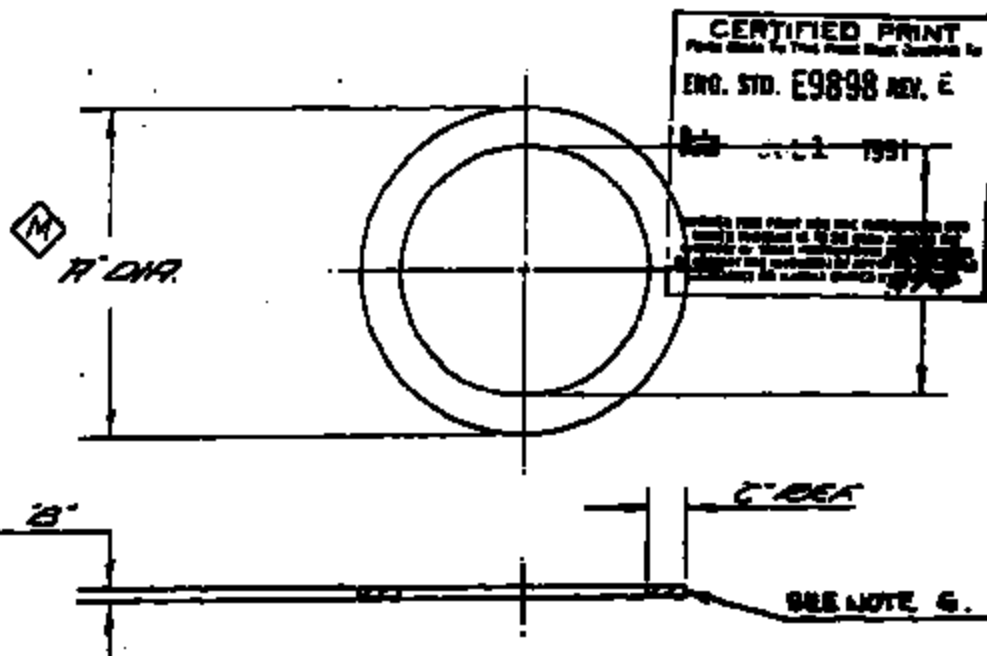
RECEIVED
DATE
TIME
LABORATORY

CONTROL

THNHTSA 002217

74353

74353



NOTES

1. PARTS MUST BE AUTHORIZED FROM THE ENGINEERING APPROVED VENDORS, LISTED BELOW.
2. MATERIAL CERTIFICATION REQUIRED WITH EVERY SHIPMENT.
3. MATERIAL TO BE COMPLIABLE WITH ASTM-A2 & ASTM-A270 OR.
4. PARTS TO BE SHIPPED, ISSUED & STORED IN SEALED PLASTIC BAGS. AND 3000 PARTS PER BAG MAX.
5. ALL CONTAINERS OF PARTS MUST BE MARKED TO REFLECT ANY MATERIAL LOT, TOOL OR PROCESS CHANGE.
6. DASH 1(-1) AND DASH 4(-4) BASKET MUST HAVE FOUR(4) WHITE STRIPING INK MARKS, EQUALLY SPACED AROUND THE CIRCUMFERENCE, AND NOT LESS THAN 1/8 INCH WIDE. NO INK IS ALLOWED ON ANY OTHER SURFACE.

74353-4	ETHYLENE PROPYLENE JBL COMPOUND E-7104-70 JBL PART NO. 6147E	70	BLACK	.670-.662	.030-.026	.063
74353-3	ETHYLENE PROPYLENE JBL COMPOUND E-7054	70	WHITE	.670-.662	.020-.026	.06
74353-2	ETHYLENE PROPYLENE JBL COMPOUND E-7054	70	WHITE	.599-.591	.030-.026	.06
74353-1	ETHYLENE PROPYLENE JBL COMPOUND E-7104-70 JBL PART NO. 6157E	70	BLACK	.599-.591	.030-.026	.06
PART NO.	MATERIAL	DIMENSIONS	COLOR	A - (H)	B - (H)	C

BY T. Dail 3-10-85
CR. [Signature] 3-10-85
ENC. [Signature] 3-11-85



TEXAS INSTRUMENTS
INCORPORATED
ATLEROBO, MASS., U.S.A.



APPENDIX A

74353

TI-NHTSA 002218

Mr. Vincent Barrow
July 29, 1991
Page 2 of 7

WHEN. Since the two pans are complete except documentation, we will finish documentation and send samples with paperwork for your preliminary review. Also, we will quote a sample price for a "plating lot size" of parts from 10821 w/o re-roll. - WHEN ? NEXT WEEK

(1) Req'd Action: Complete documentation of 36900-1 (2 pans) from 10821 and submit for preliminary review at no charge. WHEN ? - COMPLETE

(1) Req'd Action: Quote "plating lot size" sample order of 36900-1 from 10821. Monitor tensile strength and hardness of wire vs. same of finished part. WHEN - NEXT WK.

B. Rack Plating. Rack plating the parts would eliminate the tumbling action of the current plating line which would reduce/eliminate thread nicks and eliminate the need for re-roll. While rack plating would be a subcontracted operation, significantly more expensive than our internal plating, the re-roll and clamping operations would be eliminated and parts could have the red plastic caps assembled on the thread as they are removed from the rack. This could result in value added for T.I. and eliminate substantial problems with thread gaging of nicked parts.

Proposed Action: Quote parts with rack plating and caps assembled. This will eliminate re-roll and a cleaning operation. WHEN ? - 3 WKS

C. Standard Thread Tolerances. The ANSI B1.1 Thread Standard for Unified Inch Screw Threads allows coated class 2A external threads an allowance after plating. This allowance represents additional tolerance of approximately 30% on both the 3/8" and 1/2" threaded sizes, and applies to both pitch diameter and major diameter. This means 2A low limit and 3A high limit on coated threads. We have been limited to 2A limits after plate without the benefit of the allowance. The allowance may be sufficient to improve gaging and eliminate the need for re-roll.

PROPOSE CONF. CALL W/OFFICE TOMORROW
Proposed Action: T.I. to evaluate these limits. *[Signature]*

D. Dog Point. The idea of a dog point really applies to the family of parts in general. It may help reduce lead thread damage during the plating operation which results in the necessity of a re-roll operation. T.I. indicated that this will not happen on the parts for Cadillac as well as the high-volume parts due to an interference problem with the dog. They did, however, say we need to continue to push the sample order in-process with the dog point.

Req'd Action: Continue to push current sample order of P/W 36917-1.
NEED J.K. FOR CHANGES RECEIVED

PER
Eico
can use
allowance
as + to Dim.

TI-NHTSA 002219

5.9.2 External Thread. When measurement is specified, the runout of the major diameter cylinder with the pitch diameter cylinder on the external thread shall not exceed its pitch diameter tolerance.

5.10 Lead and Flank Angle Tolerances

See Section 9.

5.11 Coated or Plated Threads

See Section 7 for dimensional accommodation and limits for coated threads.

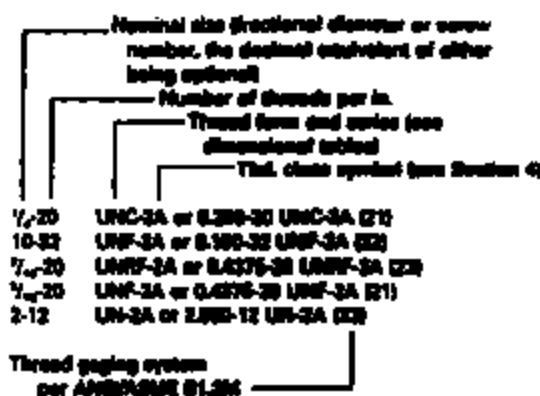
8 SCREW THREAD DESIGNATION

8.1 Basic Method of Designating

The basic method of designating a screw thread is used where the standard tolerances or limits of size based on the standard length of engagement are applicable, as indicated in Section 5.

The designation specifies in sequence the nominal size, number of threads per inch, thread series symbol, thread class symbol, and gaging system per ANSI/ASME B1.3M (see Fig. 4). The nominal size is the basic major diameter and is specified as the fractional diameter, screw number, or their decimal equivalent. Where decimal equivalents are used for size callout, they shall be shown in four place decimals (omitting the cipher in the fourth place) for fractional sizes, and in three place decimals for number sizes. They shall be interpreted as being nominal size designations only and shall have no dimensional significance beyond the fractional size or number designation. The thread series symbol indicates the thread form (refer to Section 2), series, and tolerance formulation (refer to Section 3). The thread series symbols for the UN thread form are UNC, UNF, UNEF, or UN for only those sizes of the various series shown in Table 2 and UNS for any other intermediate and larger size diameter-pitch combination having tolerances to unified formulation. The corresponding thread series symbols for the UNR thread form are UNRC, UNRF, UNREF, or UNR. The symbol UNRS corresponds to UNS. The thread class symbols are 1A, 1B, 2A, 2B, 3A, or 3B, where the suffixes A and B relate to external and internal threads, respectively.

UNS threads and threads having special length of engagement require certain additional information as shown in paras. 6.4 and 6.6.



GENERAL NOTE:

Thread acceptability gaging system replacement of ANSI/ASME B1.3M may be added to the thread size designation as noted above or as specified in pertinent documentation, such as drawing or procurement document.

FIG. 4 SCREW THREAD DESIGNATIONS

8.2 Method of Designating Coated Threads

Specification on drawings of the before and after coating dimensions for screw threads is sometimes dictated by an engineering or production consideration that the size before and after coating be controlled. This results from coated screw threads having two stages of design - the before coating stage and the after coating stage. The threaded product may be produced by a supplier and coated by a user. In this case, it is necessary that a clear understanding of the coating requirements and the allowance for coating buildup be agreed upon by both supplier and user (see Section 7).

The before coating (plating) dimensions have a definite bearing on the strength of the screw threads. The before coating stage is, therefore, decidedly an engineering consideration; it is also a production consideration in requiring that proper allowance be made for the specified coating thickness. The finished parts should be of a size after coating that will allow them to be assembled with their coating components as intended.

Recommended methods for designating coated thread under various conditions are described in the following paragraph.

8.2.1 For coated (or plated) Class 2A external threads, the basic (max.) major and basic (max.) pitch diameters shall be given, followed by the words

AFTER COATING. The major and pitch diameter limits of size before coating shall also be given, followed by the words **BEFORE COATING**.

EXAMPLE:

1/4-10 UNC-2A (21)
Major diam. 0.7500 mm. } **AFTER COATING** 2A Dim.
PD 0.6830 mm.
Major diam. 0.7482-0.7533 } **BEFORE COATING** 2A Dim.
PD 0.6832-0.6779

Certain applications require an allowance for rapid assembly to permit application of the proper lubricant or for residual growth due to high-temperature expansion. In these applications, the difference between the coated and uncoated size is not permitted to be consumed by such coating; the thread class symbol is qualified by the addition of the letter G (old symbol for allowance) following the class symbol, the minimum major and minimum pitch diameters are indicated below basic size by the amount of the 2A allowance and followed by the words **AFTER COATING**; thereby insuring that the allowance is maintained. The thread before coating must have special provisions to allow for coating thickness. The major and pitch diameter limits of size before coating (calculated in accordance with Section 7) shall also be given, followed by the letters SPL (special) and by the words **BEFORE COATING**.

EXAMPLE:

1/4-10 UNC-2AG (22)
Major diam. 0.7482 mm. } **AFTER COATING** 2A Dim.
PD 0.6832 mm.
Major diam. 0.7464-0.7533 SPL } **BEFORE COATING** 2A Dim.
PD 0.6814-0.6755 SPL

Threads accepted to Class 2A limits before coating are accepted after coating by basic size Class 3A GO thread gages. The allowance given in the dimensional tables for Class 2A thread is sufficient to allow for a limited amount of coating as described in Section 7. However, if a greater coating thickness is required, it will be necessary to calculate the before coating limits in accordance with Section 7.

8.2.2 For coated (or plated) Class 3A external threads, the maximum major and maximum pitch diameters may optionally be given, followed by the words **AFTER COATING**, thereby indicating that

the thread before coating must have special provisions to allow for coating thickness. The major and pitch diameter limits of size before coating (calculated in accordance with para. 7.5) shall be given, followed by the letters SPL (special) and by the words **BEFORE COATING**.

EXAMPLE: Thickness of coating 0.0002 in. to 0.0003 in.

1/4-20 UNF-3A (21)
Major diam. 0.2500 mm. } **AFTER COATING**
PD 0.2166 mm. } (Optional)
Major diam. 0.2494-0.2503 SPL } **BEFORE COATING**
PD 0.2256-0.2305 SPL

8.2.3 For coated (or plated) Class 1A external threads, the maximum major and maximum pitch diameters may optionally be given, followed by the words **AFTER COATING**, thereby indicating that the thread before coating must have special provisions to allow for coating thickness. The major and pitch diameter limits of size before coating (calculated in accordance with para. 7.5) shall be given, followed by the letters SPL (special) and by the words **BEFORE COATING**.

EXAMPLE: Thickness of coating 0.0002 in. to 0.0003 in.

1/4-20 UNC-1A (21)
Major diam. 0.2500 mm. } **AFTER COATING**
PD 0.2166 mm. } (Optional)
Major diam. 0.2492-0.2503 SPL } **BEFORE COATING**
PD 0.2152-0.2160 SPL

8.2.4 Where an allowance is required to accommodate coating (or plating) on Class 1B, 2B, or 3B internal threads, the minimum minor and minimum pitch diameters may optionally be given, followed by the words **AFTER COATING**. The minor and pitch diameter limits of size before coating (calculated in accordance with para. 7.6) shall be given, followed by the letters SPL (special) and by the words **BEFORE COATING**.

EXAMPLE: Thickness of coating 0.0002 in. to 0.0003 in.

1/4-20 UNC-1B (21)
Minor diam. 0.2154 mm. } **AFTER COATING**
PD 0.2173 mm. } (Optional)
Minor diam. 0.2157-0.2167 SPL } **BEFORE COATING**
PD 0.2167-0.2156 SPL

*Major and PD values are equal to basic and correspond to those in Table 3A for Class 3A.

*Major and PD limits are those in Table 3A for Class 2A.

*Major and PD limits correspond to those in Table 3A for Class 2A minus the coating allowance.

*Major and PD limits are those in Table 3A for Class 3A.

*Major and PD limits are those in Table 3A for Class 1A.

*Major and PD limits correspond to those in Table 3A for Class 1A minus the coating allowance.

poss, but without change in class of thread or pitch diameter limits. (It should be noted that standard pitch diameter gages may be used to accept such threads.) Such threads shall be specified with the established thread designation, followed by a statement of the modified diameter limits and the designation MOD. This practice also applies to modifications of internal thread minor diameters described in para. 5.6.1.

EXAMPLES:

$\frac{1}{4}$ -24 UNF-3A MOD (2I)
Major diam. 0.3750-0.3648 MOD

$\frac{1}{4}$ -20 UNF-3B MOD (2I)
Minor diam. 1.358-1.409 MOD
FD 1.4350-1.4412
Major diam. 1.300 min.

7 DIMENSIONAL ACCOMMODATION OF COATING OR PLATING FOR 60 DEG. THREADS

7.1 Introduction

It is not within the scope of this Standard to make recommendations for thickness of, or to specify limits for, coatings. However, it will aid mechanical interchangeability if certain principles are followed whenever conditions permit. The following guides should be helpful in determining the amount and direction of the alterations to establish applicable limits of size before coating. Some commonly used and firmly established processes for heavy coatings, such as hot dip galvanizing, do not fall within the scope of this Section.

NOTE: The term coating refers to one or more applications of additive material to threads, including dry film lubricants, but excluding soft or liquid lubricants that are readily displaced in assembly and gaging. Plating is therefore included as coating in this text.

This Standard specifies limits of size that pertain whether threads are coated or uncoated. Only in Class 2A threads is the allowance available to accommodate coatings. Thus, in all classes of internal threads and in all Class 1A, 2AG, and 3A external threads, limits of size must be adjusted before plating to provide suitable provision for the desired coating.

7.2 Material Limits for Coated Threads

Unless otherwise specified, size limits for standard external thread Class 2A apply prior to coating. The external thread allowance may thus be used to accommodate the coating thickness on coated parts,

provided that the maximum coating thickness is no more than one-fourth of the allowance (see Fig. 5). Thus, the thread after coating is subject to acceptance using a basic Class 3A size GO thread gage and a Class 2A thread gage for either minimum material or NOT GO. Where external thread has no allowance, or allowance must be maintained after coating, and for standard internal threads, sufficient allowance must be provided prior to coating to assure that finished product threads do not exceed the maximum-material limits specified. For thread Class 3A, Class 2A allowance is accordance with Tables 20 to 30 or Table 32 should be applied whenever possible (see paras. 7.4, 7.5, and 7.6).

7.3 Dimensional Effects of Coating

On a cylindrical surface, the effect of coating is to change the diameter by twice the coating thickness, one coating thickness on each side of the cylinder. Because the coating thickness is measured perpendicular to the coated surface, while the pitch diameter is measured perpendicular to the thread axis, the effect of a uniformly coated thread flank on the pitch diameter is a change of four times the thickness of coating on the flank (see Fig. 5). The diameters of external threads before coating will be smaller, while the diameters of internal threads before coating will be larger, than the coated diameters.

7.4 External Thread With Allowance Available for Coating

7.4.1 Maximum and Minimum Coating Thickness Specified. The amount of the allowance on the pitch diameter is sufficient for uniform coating if four times the maximum coating thickness is equal to or less than the allowance tabulated in Tables 3A, 3B, 20 to 30, or 32.

7.4.2 Only Nominal or Minimum Coating Thickness Specified. If no coating thickness tolerance is given, it is recommended that a tolerance of plus 50% of the nominal or minimum thickness be assumed. Then the amount of the allowance on the pitch diameter is sufficient for uniform coating if six times the specified coating thickness is equal to or less than the allowance tabulated in Tables 3A, 3B, 20 to 30, or 32.

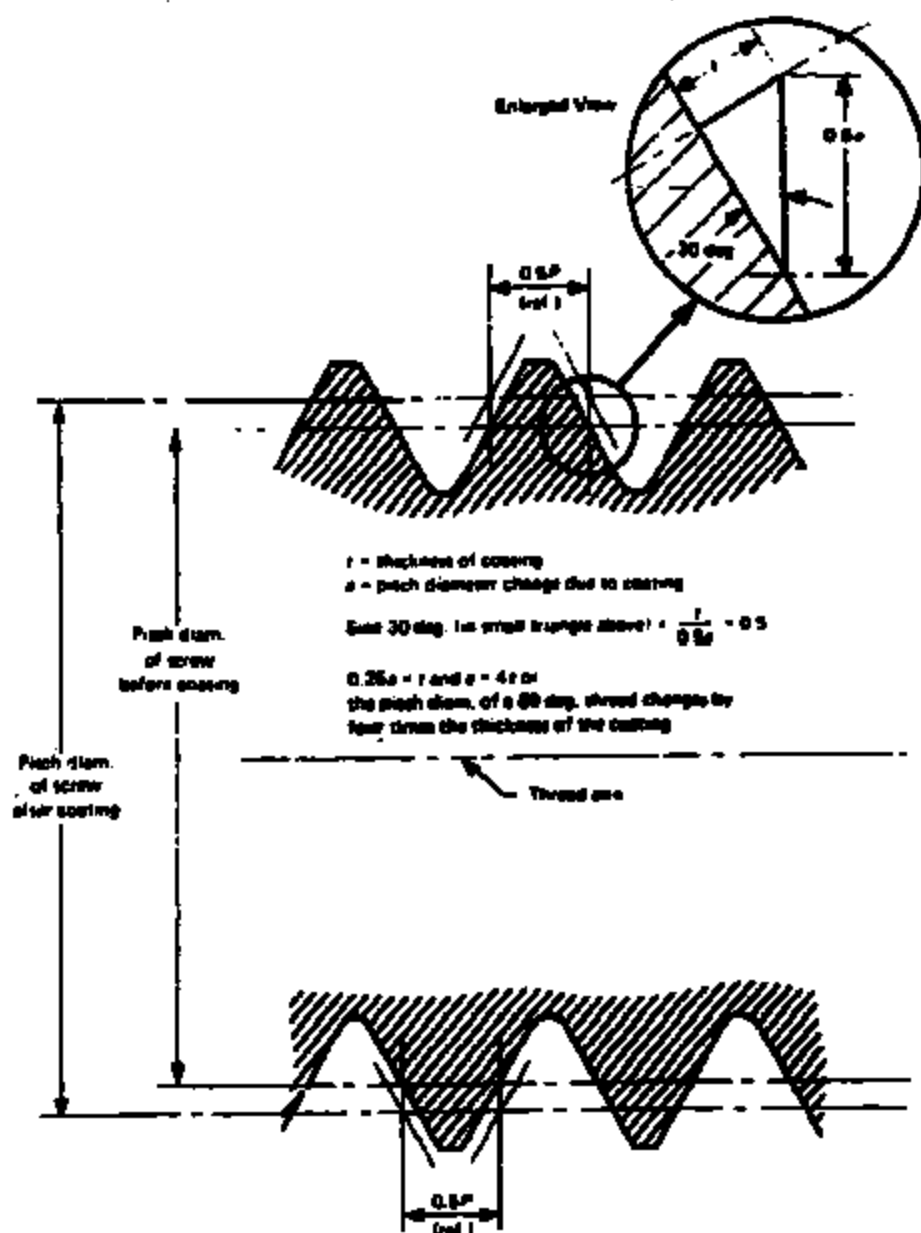


FIG. 5 RATIO OF PITCH DIAMETER CHANGE TO THICKNESS OF COATING ON 60 DEG. THREADS

7.5 External Thread With No Allowance for Coating

7.5.1 Maximum and Minimum Coating Thickness Specified. To determine before coating gaging limits for a uniformly coated thread, decrease:

- (a) the maximum pitch diameter by four times the maximum coating thickness;
- (b) the minimum pitch diameter by four times the minimum coating thickness;
- (c) the maximum major diameter by two times the maximum coating thickness;
- (d) the minimum major diameter by two times the minimum coating thickness.

EXAMPLE

$\frac{1}{8}$ -16 UNC-2A (21) AFTER COATING
Coating thickness 0.0003-0.0005 in.

To determine the before coating maximum-material sizes, decrease the maximum pitch diameter of 0.3331 in. by 0.0012 in. (4×0.0003) to 0.3319 in., and the maximum major diameter of 0.3757 in. by 0.0006 in. (2×0.0003) to 0.3751 in. For the before coating minimum sizes, decrease the minimum pitch diameter of 0.3287 in. by 0.0008 in. (4×0.0002) to 0.3279 in., and the minimum major diameter of 0.3643 in. by 0.0004 in. (2×0.0002) to 0.3639 in. The before coating sizes should be included in the thread designation (see para. 6.2.1).

7.5.2 Only Nominal or Minimum Coating Thickness Specified. If no coating thickness tolerance is given, it is recommended that a tolerance of plus 50% of the nominal or minimum thickness be assumed. Then, to determine before coating gaging limits for a uniformly coated thread, decrease:

- (a) the maximum pitch diameter by six times the coating thickness;
- (b) the minimum pitch diameter by four times the coating thickness;
- (c) the maximum major diameter by three times the coating thickness;
- (d) the minimum major diameter by two times the coating thickness.

EXAMPLE

$\frac{1}{8}$ -16 UNC-3A (22)
Coating thickness 0.0004 in.

Since the allowance for Class 2A thread is 0.0015 in., the nominal or minimum coating thickness that may be applied is equal to 0.0015 in. divided by six, or 0.00025 in. (the maximum thickness of coating that may be applied is equal to 0.0015 divided by four or 0.00038 in.). This is not sufficient for the required nominal or minimum coating of 0.0004 in. specified,

so additional adjustments to the before coating pitch and major diameters must be made.

To determine the before coating maximum-material sizes, decrease the maximum pitch diameter of 0.4500 in. by 0.0024 in. (6×0.0004) to 0.4476 in., and the maximum major diameter of 0.5000 in. by 0.0012 in. (3×0.0004) to 0.4988 in. For the before coating minimum sizes, decrease the minimum pitch diameter of 0.4463 in. by 0.0016 in. (4×0.0004) to 0.4447 in., and the minimum major diameter of 0.4891 in. by 0.0008 in. (2×0.0004) to 0.4883 in. The before coating sizes should be included in the thread designation (see para. 6.2.1).

7.5.3 Adjusted Size Limits. It should be noted in the preceding examples that the before coating material limit tolerances are less than the tolerances after coating. This is because the coating tolerance consumes some of the product tolerance. In some instances, there may be insufficient pitch diameter tolerance available in the before coating condition, so that additional adjustments and controls will be necessary.

7.5.4 Strength. On small thread sizes (0.190 in. and smaller), there is a possibility that coating thickness adjustments will cause loss material (minimum) conditions that may significantly affect the strength of externally threaded parts. Limitations on coating thickness, or part redesign, may be necessary.

7.6 Internal Threads

Standard internal threads provide no allowance for coating thickness. To determine before coating gaging limits for a uniformly coated thread, increase:

- (a) the minimum pitch diameter by four times the maximum coating thickness, if specified, or by six times the minimum or nominal coating thickness, if not specified;
- (b) the maximum pitch diameter by four times the minimum or nominal coating thickness;
- (c) the minimum minor diameter by two times the maximum coating thickness, if specified, or by three times the minimum or nominal coating thickness, if not specified;
- (d) the maximum minor diameter by two times the minimum or nominal coating thickness.

7.7 Other Considerations

It is essential to adequately review all possibilities and consider limitations in the threading and coating production processes before finalizing the coating

TABLE 3A LIMITS OF SIZE FOR STANDARD SERIES THREADS (UN/UNF) (CONT'D)

Nominal Size and Thread	Series Designation	External (M)										Internal (N)							
		Class	Pitch Diameter	Major Diameter			Pitch Diameter			Tolerances	Min. (N)	Class	Major Diameter		Pitch Diameter			Tolerances	Min.
				Max. (M)	Min.	Min. (M)	Max. (M)	Min.	Max. (M)				Min.	Max.	Min.	Max.			
1/16 or 0.375-16	UNC	1A	0.8012	0.3737	0.3885	...	0.3831	0.3885	0.0008	0.2902	0.2902	1B	0.307	0.321	0.3344	0.3428	0.0008	0.3780	
		2A	0.8013	0.3737	0.3843	0.3885	0.3831	0.3867	0.0044	0.2882	0.2882	2B	0.307	0.321	0.3344	0.3401	0.0057	0.3780	
		3A	0.8000	0.3750	0.3885	...	0.3844	0.3911	0.0023	0.2805	0.2805	3B	0.3070	0.3162	0.3344	0.3507	0.0043	0.3760	
1/8 or 0.375-20	UN	2A	0.8012	0.3738	0.3887	...	0.3819	0.3872	0.0041	0.3143	0.3143	2B	0.321	0.332	0.3425	0.3478	0.0084	0.3780	
		3A	0.8000	0.3750	0.3885	...	0.3836	0.3894	0.0031	0.3158	0.3158	3B	0.3210	0.3287	0.3425	0.3485	0.0040	0.3780	
1/4 or 0.375-24	UNF	1A	0.8011	0.3738	0.3831	...	0.3808	0.3811	0.0007	0.3248	0.3248	1B	0.330	0.340	0.3478	0.3533	0.0074	0.3780	
		2A	0.8011	0.3738	0.3867	...	0.3808	0.3830	0.0008	0.3243	0.3243	2B	0.330	0.340	0.3478	0.3538	0.0048	0.3780	
		3A	0.8000	0.3750	0.3878	...	0.3819	0.3898	0.0009	0.3284	0.3284	3B	0.3300	0.3372	0.3478	0.3518	0.0037	0.3760	
1/2 or 0.375-28	UNF	2A	0.8011	0.3738	0.3874	...	0.3887	0.3871	0.0008	0.3312	0.3312	2B	0.338	0.348	0.3518	0.3584	0.0048	0.3780	
		3A	0.8000	0.3750	0.3885	...	0.3819	0.3881	0.0027	0.3334	0.3334	3B	0.3380	0.3434	0.3518	0.3583	0.0036	0.3760	
3/4 or 0.375-32	UNF	2A	0.8010	0.3740	0.3880	...	0.3837	0.3803	0.0004	0.3388	0.3388	2B	0.341	0.348	0.3547	0.3587	0.0044	0.3780	
		3A	0.8000	0.3750	0.3880	...	0.3847	0.3822	0.0005	0.3378	0.3378	3B	0.3410	0.3488	0.3547	0.3580	0.0033	0.3760	
1-14 or 0.4375-14	UNC	1A	0.8014	0.4381	0.4708	...	0.4687	0.4686	0.0071	0.3811	0.3811	1B	0.380	0.378	0.3811	0.4005	0.0082	0.4378	
		2A	0.8014	0.4381	0.4688	0.4708	0.4687	0.4688	0.0047	0.3811	0.3811	2B	0.380	0.378	0.3811	0.3872	0.0051	0.4378	
		3A	0.8000	0.4378	0.4721	...	0.4611	0.4678	0.0008	0.3828	0.3828	3B	0.3800	0.3717	0.3811	0.3867	0.0046	0.4378	
1-16 or 0.4375-16	UN	2A	0.8014	0.4381	0.4683	...	0.4686	0.4688	0.0048	0.3818	0.3818	2B	0.378	0.384	0.3888	0.4008	0.0080	0.4378	
		3A	0.8000	0.4378	0.4681	...	0.4688	0.4685	0.0004	0.3838	0.3838	3B	0.3780	0.3800	0.3888	0.4014	0.0048	0.4378	
1-20 or 0.4375-20	UNF	1A	0.8013	0.4380	0.4640	...	0.4687	0.4678	0.0063	0.3767	0.3767	1B	0.380	0.388	0.4080	0.4131	0.0081	0.4378	
		2A	0.8013	0.4380	0.4591	...	0.4627	0.4686	0.0043	0.3767	0.3767	2B	0.380	0.388	0.4080	0.4184	0.0054	0.4378	
		3A	0.8000	0.4378	0.4584	...	0.4680	0.4619	0.0021	0.3788	0.3788	3B	0.3800	0.3818	0.4088	0.4087	0.0041	0.4378	
1-28 or 0.4375-28	UNF	2A	0.8011	0.4384	0.4598	...	0.4622	0.4686	0.0036	0.3888	0.3888	2B	0.388	0.407	0.4148	0.4188	0.0048	0.4378	
		3A	0.8000	0.4378	0.4580	...	0.4643	0.4618	0.0027	0.3848	0.3848	3B	0.3880	0.4051	0.4148	0.4178	0.0036	0.4378	
1-32 or 0.4375-32	UN	2A	0.8010	0.4388	0.4588	...	0.4623	0.4618	0.0034	0.3883	0.3883	2B	0.404	0.411	0.4172	0.4218	0.0044	0.4378	
		3A	0.8000	0.4378	0.4518	...	0.4612	0.4617	0.0005	0.4088	0.4088	3B	0.4040	0.4088	0.4172	0.4288	0.0033	0.4378	
1-1/2 or 0.500-12	UNC	1A	0.8015	0.4988	0.4823	...	0.4888	0.4811	0.0034	0.4088	0.4088	1B	0.417	0.424	0.4508	0.4687	0.0087	0.5000	
		2A	0.8015	0.4988	0.4878	0.4823	0.4888	0.4838	0.0005	0.4088	0.4088	2B	0.417	0.424	0.4508	0.4588	0.0088	0.5000	
		3A	0.8000	0.5000	0.4851	...	0.4888	0.4853	0.0007	0.4084	0.4084	3B	0.4178	0.4284	0.4508	0.4548	0.0048	0.5000	
1-1/8 or 0.500-18	UN	2A	0.8014	0.4988	0.4882	...	0.4888	0.4833	0.0047	0.4241	0.4241	2B	0.408	0.448	0.4584	0.4688	0.0081	0.5000	
		3A	0.8000	0.5000	0.4888	...	0.4884	0.4888	0.0005	0.4288	0.4288	3B	0.4230	0.4418	0.4584	0.4688	0.0044	0.5000	
1-3/4 or 0.500-20	UNF	1A	0.8013	0.4987	0.4888	...	0.4882	0.4888	0.0004	0.4382	0.4382	1B	0.448	0.457	0.4678	0.4788	0.0084	0.5000	
		2A	0.8013	0.4987	0.4888	...	0.4882	0.4818	0.0043	0.4382	0.4382	2B	0.448	0.457	0.4678	0.4721	0.0088	0.5000	
		3A	0.8000	0.5000	0.4818	...	0.4878	0.4843	0.0032	0.4488	0.4488	3B	0.4488	0.4587	0.4678	0.4717	0.0043	0.5000	

(Notes follow at end of table)

UNIFIED NCH SCREW THREADS

ASME B1.1-1983

P. D.'s

UNIFIED SCREW THREADS

Table 32. Extra-Fine Thread Series, UNEF and UNEF — Basic Dimensions

Nominal Diameter, D Inches	Pitch, P Inches	Basic Pitch Diameter, D_2 Inches	Minor Diameter, D_3 Inches		Lead Angle, λ in Basic P.D. Deg. Min.	Area of Minor Section, A_m Sq. In.	Thread Stress Area, A_s Sq. In.
			UNEF	UNEF			
1/16	0.040	0.100	0.085	0.085	1 30	0.0004	0.0004
5/64	0.03125	0.075	0.0625	0.0625	1 30	0.0001	0.0001
3/32	0.025	0.0625	0.050	0.050	1 30	0.0001	0.0001
1/8	0.020	0.050	0.040	0.040	1 30	0.0001	0.0001
5/16	0.015625	0.0375	0.03125	0.03125	1 30	0.0001	0.0001
3/8	0.0125	0.03125	0.025	0.025	1 30	0.0001	0.0001
7/16	0.0109375	0.0271875	0.021875	0.021875	1 30	0.0001	0.0001
1/2	0.009375	0.0234375	0.01875	0.01875	1 30	0.0001	0.0001
5/8	0.0078125	0.0196875	0.015625	0.015625	1 30	0.0001	0.0001
3/4	0.00625	0.0159375	0.0125	0.0125	1 30	0.0001	0.0001
7/8	0.00546875	0.0140625	0.0109375	0.0109375	1 30	0.0001	0.0001
1	0.0046875	0.0121875	0.009375	0.009375	1 30	0.0001	0.0001
1 1/8	0.00390625	0.0103125	0.0078125	0.0078125	1 30	0.0001	0.0001
1 1/4	0.003125	0.0084375	0.00625	0.00625	1 30	0.0001	0.0001
1 3/8	0.00234375	0.0065625	0.0046875	0.0046875	1 30	0.0001	0.0001
1 1/2	0.0015625	0.0046875	0.003125	0.003125	1 30	0.0001	0.0001
1 5/8	0.001171875	0.0033125	0.0021875	0.0021875	1 30	0.0001	0.0001
2	0.0009375	0.0021875	0.0015625	0.0015625	1 30	0.0001	0.0001
2 1/4	0.00078125	0.0015625	0.00109375	0.00109375	1 30	0.0001	0.0001
2 1/2	0.000625	0.00109375	0.00078125	0.00078125	1 30	0.0001	0.0001
2 3/4	0.00046875	0.00078125	0.000546875	0.000546875	1 30	0.0001	0.0001
3	0.0003125	0.00046875	0.0003125	0.0003125	1 30	0.0001	0.0001
3 1/4	0.000234375	0.0003125	0.00021875	0.00021875	1 30	0.0001	0.0001
3 1/2	0.00015625	0.00021875	0.00015625	0.00015625	1 30	0.0001	0.0001
3 3/4	0.0001171875	0.00015625	0.000109375	0.000109375	1 30	0.0001	0.0001
4	0.00009375	0.000109375	0.00009375	0.00009375	1 30	0.0001	0.0001

* Secondary units.
* Basic Pitch Diameter.
* See formula, page 1476.
* Groups have for lead threads. (See figure on page 1474.)
* Basic stress diameter.

Other Threads of Special Dimensions, Pitches, and Lengths of Engagement. Thread data for special combinations of diameter, pitch, and length of engagement not included in selected combinations are also given in the Standard but are not given here. Also, when design considerations require non-standard pitches or extreme conditions of engagement not covered by the tables, the allowance and tolerances should be derived from the formulas in the Standard. The thread symbol for each special thread is UNEF.

Thread Classes. — Thread classes are distinguished from each other by the amount of tolerance and allowance. Classes identified by a numeral followed by the letters A and B are derived from certain limited formulas that show limits in which the pitch diameter tolerances are based on increments of the basic major diameter, the pitch, and the length of engagement. These formulas and the classification in symbols apply to all of the Unified threads.

Classes 1A, 2A, and 3A apply to external threads only, and Classes 1B, 2B, and 3B apply to internal threads only. The disposition of the tolerances, allowances, and class tolerances for the various classes is illustrated on pages 1484 and 1484.

Classes 2A and 2B (Classes 2A and 2B are the most commonly used for general applications including precision and ball screws, nuts, and similar fasteners).

UNIFIED SCREW THREADS

Table 33. Fine Thread Series, UNF and UNF — Basic Dimensions

Nominal Diameter, D Inches	Pitch, P Inches	Basic Pitch Diameter, D_2 Inches	Minor Diameter, D_3 Inches		Lead Angle, λ in Basic P.D. Deg. Min.	Area of Minor Section, A_m Sq. In.	Thread Stress Area, A_s Sq. In.
			UNF	UNF			
1/16	0.075	0.0875	0.075	0.075	1 30	0.0004	0.0004
5/64	0.0625	0.075	0.0625	0.0625	1 30	0.0001	0.0001
3/32	0.050	0.0625	0.050	0.050	1 30	0.0001	0.0001
1/8	0.040	0.050	0.040	0.040	1 30	0.0001	0.0001
5/16	0.03125	0.0375	0.03125	0.03125	1 30	0.0001	0.0001
3/8	0.025	0.03125	0.025	0.025	1 30	0.0001	0.0001
7/16	0.020	0.0271875	0.021875	0.021875	1 30	0.0001	0.0001
1/2	0.015625	0.0234375	0.01875	0.01875	1 30	0.0001	0.0001
5/8	0.0125	0.0196875	0.015625	0.015625	1 30	0.0001	0.0001
3/4	0.0109375	0.0171875	0.0140625	0.0140625	1 30	0.0001	0.0001
7/8	0.009375	0.0159375	0.0125	0.0125	1 30	0.0001	0.0001
1	0.0078125	0.0140625	0.0109375	0.0109375	1 30	0.0001	0.0001
1 1/8	0.00625	0.0121875	0.009375	0.009375	1 30	0.0001	0.0001
1 1/4	0.00546875	0.0103125	0.0078125	0.0078125	1 30	0.0001	0.0001
1 3/8	0.0046875	0.0084375	0.00625	0.00625	1 30	0.0001	0.0001
1 1/2	0.00390625	0.0065625	0.0046875	0.0046875	1 30	0.0001	0.0001
1 5/8	0.003125	0.0046875	0.003125	0.003125	1 30	0.0001	0.0001
2	0.00234375	0.0033125	0.0021875	0.0021875	1 30	0.0001	0.0001
2 1/4	0.0015625	0.0021875	0.0015625	0.0015625	1 30	0.0001	0.0001
2 1/2	0.001171875	0.0015625	0.00109375	0.00109375	1 30	0.0001	0.0001
2 3/4	0.0009375	0.00109375	0.0009375	0.0009375	1 30	0.0001	0.0001
3	0.00078125	0.00078125	0.00078125	0.00078125	1 30	0.0001	0.0001
3 1/4	0.000625	0.000546875	0.000546875	0.000546875	1 30	0.0001	0.0001
3 1/2	0.00046875	0.00046875	0.00046875	0.00046875	1 30	0.0001	0.0001
3 3/4	0.0003125	0.0003125	0.0003125	0.0003125	1 30	0.0001	0.0001
4	0.000234375	0.000234375	0.000234375	0.000234375	1 30	0.0001	0.0001
4 1/4	0.00015625	0.00015625	0.00015625	0.00015625	1 30	0.0001	0.0001
4 1/2	0.0001171875	0.0001171875	0.0001171875	0.0001171875	1 30	0.0001	0.0001
4 3/4	0.00009375	0.00009375	0.00009375	0.00009375	1 30	0.0001	0.0001
5	0.000078125	0.000078125	0.000078125	0.000078125	1 30	0.0001	0.0001

* There are standard sizes of the UNF series.
* Basic Pitch Diameter.
* See formula, page 1476.
* Groups have for lead threads. (See figure on page 1474.)
* Basic stress diameter.

The maximum diameter of Class 2A (external) threaded threads are less than basic by the amount of the allowance. The allowance minimizes galling and scoring in high-speed screw assembly, or it can be used to accommodate plastic fasteners or other coating. However, for threads with additive finish, the maximum diameter of Class 2A may be exceeded by the amount of the allowance; for example, the 2A maximum diameter apply to an unplated part or to a part before plating whereas the basic diameter of Class 2A maximum diameter (plus allowance) apply to a part after plating. The maximum diameter of Class 2B (internal) threads, whether or not plated or coated, are basic, affecting no allowance or clearance in assembly at maximum metal layer.

CHROMIUM Certain applications require an allowance for rapid assembly to prevent application of the proper lubricant or for residual growth due to high temperature expansion in these applications, when the thread is coated and the 2A allowance is not permitted to be compensated by such coating, the thread class symbol is qualified by C following the class symbol.

(Continued on page 1488)

Class 2A gage as a NOT-GO gage. Class 1A provides an allowance which is not listed for both coated and uncoated product, i.e., it is not available for coating.

Class 3A does not include an allowance so it is suggested that the limits of size before plating be reduced by the amount of the 2A allowance whenever that allowance is adequate.

No provision is made for overcoating internal threads or coatings on such threads are not generally required. Further, it is very difficult to deposit a significant thickness of coating on the flanks of internal threads. Where a specific thickness of coating is required on an internal thread, it is suggested that the thread be overcoat so that the thread as coated will be accepted by a GO thread plug gage of basic size.

This Standard (ANSI B1.1-1973) specifies limits of size that permit whole threads to be coated or uncoated. Only in Class 2A threads is an allowance available to accommodate coatings. Thus, in all classes of internal threads and in all Class 1A, 2AG, and 3A external threads, limits of size must be adjusted to provide minute provisions for the desired coating.

For further information concerning dimensional accommodation of coating or plating for 60-degree threads, see Section 7, ANSI B1.1-1973.

Screw Thread Selection — Combination of Classes. — Whenever possible, selection should be made from Table 1, Standard Series Unified Screw Threads, preference being given to the Coarse- and Fine-thread Series. If threads in the standard series do not meet the requirements of design, reference should be made to the selected combinations in Table 4. The third column in it contains the limits of size from the tolerance tables or tolerance increments (when given in the Standard). The fourth and last column is calculated by the formulas given in the Standard.

The requirements for screw thread fits for specific applications depend on end use and can be met by specifying the proper combinations of thread classes for the components. For example, a Class 1A external thread may be used with a Class 1B, 2B, or 3B internal thread.

Pitch Diameter Tolerances, All Classes. — The pitch diameter tolerances in Table 4 for all classes of the UNC, UNF, 4UN, 6UN, and 8UN series are based on a length of engagement equal to the basic major (external) diameter and are applicable to lengths of engagement up to 1½ diameters.

The pitch diameter tolerances used in Table 4 for all classes of the UNF, 10UN, 12UN, 14UN, 16UN, and 20UN series and the UNS series are based on a length of engagement of 9 threads and are applicable for lengths of engagement of from 5 to 18 threads.

Screw Thread Designation. — The basic method of designating a screw thread is used where the standard tolerances or limits of size based on the standard length of engagement are applicable. The designation specifies in sequence the nominal size, number of threads per inch, thread series symbol, thread class symbol, and, finally, gaging system number per ANSI B1.1. The nominal size is the basic major diameter and is specified in the fractional diameter, decimal number, or three decimal number form. Where decimal equivalents are used for size call-out they shall be interpreted as being nominal size designations only and shall have no dimensional significance beyond the fractional size or number designation. The symbol LH is placed after the thread class symbol to indicate a left-hand thread.

Examples: ¾-20 UNC-2A (1) or ¾-20 UNC-1A (2)
 10-32 UNF-2A (1) or 10-32 UNF-1A (2)
 ¾-20 UNF-1A (1) or ¾-20 UNF-2A (2)
 1-8 UN-1A (1) or 1-8 UN-2A (2)
 ¾-20 UNC-1A-LH (1) or ¾-20 UNC-1A-LH (2)

Formulated standard series threads that designations may optionally be supplied by the addition of the pitch diameter limits of size.

Example: ¾-20 UNC-2A (1)
 PD 0.5164-0.5177 (Optional for uncoated threads)

Designating Coated Threads. — For coated (or plated) Class 2A external threads, the basic (unst) major and basic (unst) pitch diameters are given followed by the words AFTER COATING. The major and pitch diameter limits of size before coating are given followed by the words BEFORE COATING.

Example: ¾-20 UNC-2A (1)
 Major dia 0.7500 max
 PD 0.5164 min
 Major dia 0.746-0.753
 PD 0.5072-0.5177

AFTER COATING

BEFORE COATING

3A Dims.

2A Dims.

Certain applications require an allowance for rapid assembly, to permit application of a gasket interface, or for residual growth due to high temperature expansion. In such applications where the thread is to be coated and the 2A allowance is not permitted to be consumed by such coating, the thread class symbol is qualified by the addition of the letter G (symbol for allowance) following the class symbol, and the minimum major and minimum pitch diameters are reduced below basic size by the amount of the 2A allowance and followed by the words AFTER COATING. This means that the allowance is maintained. The major and pitch diameter limits of size before coating are also given followed by SPL and BEFORE COATING. For information concerning the designating of this and other special coating conditions refer to thread fit guide to American National Standard ANSI B1.1-1973.

Designating UNS Threads. — UNS screw threads which have special combinations of diameter and pitch with tolerance to Unified form have the basic form designation not and first followed always by the limits of size.

Designating Multiple Start Threads. — If a screw thread is of multiple start it is designated by specifying in sequence the nominal size, pitch in decimals or threads per inch and lead in decimals or fractions.

Other Special Designations. — For other special designations including threads with modified limits of size or with special lengths of engagement, reference should be made to American National Standard ANSI B1.1-1973.

Notes About Tapping. — Hole size limits for tapping Classes 1B, 2B, and 3B and limits of various lengths of engagement are given in the Tapping Section.

Internal Thread Minor Diameter Tolerances. — Internal thread minor diameter tolerances in Table 4 are based on a length of engagement equal to the nominal diameter. For general applications these tolerances are suitable for lengths of engagement up to 1½ diameters. However, some limited applications have lengths of engagement which are greater than 1½ diameters or less than the nominal diameter. For such applications it may be advantageous to increase or decrease the tolerance accordingly, as explained in the Tapping Section.

*Major and PD limits are equal for both and correspond to those in Table 4 for 1 and 2A.
 *Major and PD limits are shown in Table 4 for 1 and 2A.

(R) AUTOMOTIVE TUBE FITTINGS—SAE J512 JUN90

SAE Standard

Report of the Automotive Fittings Division, approved June 1918, last revised by the Field Conference and Conversion Technical Committee November 1978, editorial change October 1988. Completely revised by the Field Conference and Conversion Technical Committee June 1990.

1. Scope.—This SAE Standard covers complete general and dimensional specifications for the various types of tube fittings intended for general application in the automotive, appliance, and allied fields.

Flare type fittings shall be as specified in Figures 1 to 4 and Tables 3 to 5.

Note: For sizes $\frac{1}{8}$ to $\frac{1}{2}$ and $\frac{3}{4}$ to $1\frac{1}{2}$ the flare type fittings depicted in Figures 1A to 3C are identical with the corresponding refrigeration tube fittings specified in SAE J515. Special die combination fittings $\frac{1}{8}$ to $\frac{1}{2}$ and $\frac{3}{4}$ to $1\frac{1}{2}$ shall be as specified in J515.

Inverted flare type fittings shall be as specified in Figures 5 to 11 and Tables 3, 6, 7, 8, and 9. Gages and gaging procedures pertaining to inverted flare tube fittings are given in Appendix A.

Note: The cast dimensions specified in Table 6 are predicated on practical threading limitations in steel fittings and use of these fittings with double flared tubing. Therefore, whenever purchasers contemplate using these fittings with single flared tubing, it is recommended fitting manufacturers be consulted even though it has been common practice to provide slightly deeper threads in brass fittings.

Tapered sleeve compression type fittings intended for general use with annealed copper alloy tubing shall be as specified in Figures 12 to 17, and Tables 3, 10, 11, and 12. To assure satisfactory performance, spherical sleeve compression type fitting components (see SAE J240) should not be intermixed with tapered sleeve compression type fitting components when assembling connections in areas where both types are available.

Dimensions of single and double 45 degree flares on tubing to be used in conjunction with flared and inverted flared fittings are given in Figure 2 and Table 3 of SAE J553.

The following general specifications supplement the dimensional data for all types of fittings contained in Tables 3 to 15 with respect to all unspecified detail.

1. References

1.1 Applicable Documents

SAE J446, Spherical and Flanged Sleeve (Compression) Tube Fittings

SAE J476, Dryseal Pipe Threads

SAE J515, Refrigeration Tube Fittings

SAE J593, Flares for Tubing

SAE J848, Coding Systems for Identification of Fluid Connectors and Connections

ANSI B1.1, Screw Threads

ASTM B 117

1.2 General Specifications

1.2.1 Size Designations.—Fitting sizes are designated by the corresponding outside diameter of the tubing for the various types of tube ends and by the corresponding standard nominal pipe size for pipe thread ends.

1.2.2 Dimensions and Tolerances.—Except for nominal sizes and thread specifications, dimensions and tolerances are given in both U. S. customary and SI units as designated. Tabulated dimensions shall apply to the finished parts, plated or otherwise processed, as specified by the purchaser. Unless otherwise specified, the maximum and minimum across flats dimensions shall be within the commercial tolerance of bar or extruded stock from which the fittings are produced. The minimum across corners dimensions of hexagons shall be 1.000 times the nominal width across flats, but shall not result in a side flat width less than 0.45 times the nominal width across flats.

Unless otherwise specified, tolerance on hole diameters designated drill in the dimensional tables shall be as tabulated in Table 1:

TABLE 1—DIMENSIONS AND TOLERANCES

Drill Size Range		Tolerance on Hole Diameter			
		Plus		Minus	
in	mm	in	mm	in	mm
0.0150 to 0.1875	0.393 to 4.763	0.003	0.08	0.003	0.08
0.1875 to 0.2400	4.763 to 6.096	0.004	0.10	0.003	0.08
0.2500 to 0.3750	6.350 to 9.525	0.006	0.15	0.003	0.08
0.3750 to 1.0000	9.525 to 25.400	0.007	0.18	0.004	0.10

Tolerance on all dimensions not otherwise limited shall be ± 0.010 in (± 0.25 mm). Angular tolerance on axis of ends on elbows, tees, and crosses shall be ± 2.50 degrees for sizes up to and including $\frac{1}{2}$ in, and ± 1.50 degrees for sizes larger than $\frac{1}{2}$ in.

Integral internal seats in inverted flared tube fittings shall be concentric with straight thread pitch diameters within 0.005 in (± 0.13 mm) full indicator reading (FIR). Unless otherwise specified, flaring seats shall be concentric with straight thread pitch diameters within 0.010 in (± 0.25 mm) full indicator reading (FIR).

Where so illustrated and not otherwise specified, hexagon corners shall be chamfered 30 degrees ± 5 to a diameter equal to the nominal width across flats, with a tolerance of -0.010 in (-0.41 mm) or where design permits, corners may be chamfered to the diameter of the starting surface provided the length of chamfer does not exceed that produced by the 30 degree chamfer previously described.

1.3 Passages.—Where passages in straight fittings are machined from opposite ends, the effect at the meeting point shall not exceed 0.015 in (± 0.38 mm). The cross-sectional area at the junction of passages in angle fittings shall not be less than that of the smallest passage. Where the passage is specified as a maximum, or as top drill diameter or less, the minimum shall be no less than the minimum diameter of the smallest passage in the fitting.

1.4 Wall Thickness.—Unless otherwise designated, the wall thickness at any point on fittings shall not be less than the thickness established by the specified dimensions, tolerances, and circumstances for size and end use.

1.5 Centers.—Details of centers shall be optional with suitable care provided the tabulated dimensions are maintained and service ability of the fittings is not impaired. Wrench flats on elbows and tees shall be optional. Where extruded or forged shapes are reduced to conserve material, the wall thickness, unless otherwise specified, shall not be less than the respective minimum values tabulated in Table 7.

TABLE 3—WALL THICKNESS

Nominal Size, in	160 Minimum, mm			
	Latented Shape ^a		Forged Shape	
	in	mm	in	mm
1/8	0.04	1.0	0.040	1.02
3/16	0.04	1.0	0.040	1.02
1/4	0.04	1.0	0.041	1.04
5/16	0.05	1.3	0.041	1.04
3/8	0.05	1.3	0.040	1.02
7/16	0.05	1.3	0.040	1.02
1/2	0.05	1.3	0.040	1.02
5/8	0.05	1.3	0.040	1.02
3/4	0.06	1.6	0.040	1.02
7/8	0.06	1.6	0.040	1.02
1	0.06	1.6	0.040	1.02

^aApplies to reduction in one plane of shape only.

1.6 Straight Threads.—Unified Standard Class 2A external threads and Class 2B internal threads with minor diameters, where specified, modified to Class 3B limits, shall apply to plain finish (unplated) fittings of all types. For externally threaded parts with additive finish, the minimum diameters of Class 2A may be exceeded by the amount of the allowance; that is, the base diameters (Class 2A maximum diameters plus the allowance) shall apply to an externally threaded part after plating. For internally threaded parts with additive finish, the Class 2B diameters and modified minor diameters shall apply after plating.

The pitch diameter tolerance shall be the same as the corresponding diameter-pitch combination and the class of the Unified coarse and fine thread series or for special diameter-pitch combinations shall be based on diameter, pitch, and a length of engagement of 9 times the pitch. See ANSI B1.1.

Where external threads are produced by roll threading and the tool is not underdrill, the unthreaded portion of both adjacent to the shoulder may be reduced to the minimum pitch diameter.

TABLE 2—STANDARD THREAD SPECIFICATION DATA, IN.

Nominal Size	Series Designation	External Thread		Internal Thread				Nominal Size	Series Designation	External Thread		Internal Thread					
		Pitch Diameter		Pitch Diameter		Minor Diameter				Pitch Diameter		Pitch Diameter		Minor Diameter			
		Max	Min	Max	Min	Max ^a	Min ^a			Min ^b	Max	Min	Max ^a	Min ^a	Min ^b		
1/16-28	UNF	0.2642	0.2666	0.2992	0.2964	0.2724	0.277	0.267	11/16-18	UNF	0.8580	0.8553	0.8372	0.8345	0.8137	0.8110	
1/8-32	UNF	0.3643	0.3667	0.3997	0.3969	0.3731	0.378	0.368	1 1/16-18	UNF	1.6448	1.6421	1.6213	1.6186	1.5978	1.5951	
1/4-20	UNF	0.4643	0.4667	0.4997	0.4969	0.4731	0.478	0.468	1 1/8-18	UNF	1.8448	1.8421	1.8213	1.8186	1.7978	1.7951	
3/8-16	UNF	0.5643	0.5667	0.5997	0.5969	0.5731	0.578	0.568	1 3/8-18	UNF	2.0448	2.0421	2.0213	2.0186	1.9978	1.9951	
1/2-12	UNF	0.6643	0.6667	0.6997	0.6969	0.6731	0.678	0.668	2-12	UNF	2.4448	2.4421	2.4213	2.4186	2.3978	2.3951	
5/8-11	UNF	0.7643	0.7667	0.7997	0.7969	0.7731	0.778	0.768	2 1/2-12	UNF	2.6448	2.6421	2.6213	2.6186	2.5978	2.5951	
3/4-10	UNF	0.8643	0.8667	0.8997	0.8969	0.8731	0.878	0.868	3-12	UNF	2.8448	2.8421	2.8213	2.8186	2.7978	2.7951	
7/8-9	UNF	0.9643	0.9667	0.9997	0.9969	0.9731	0.978	0.968	3 1/2-12	UNF	3.0448	3.0421	3.0213	3.0186	2.9978	2.9951	
1-8	UNF	1.0643	1.0667	1.0997	1.0969	1.0731	1.078	1.068	4-12	UNF	3.2448	3.2421	3.2213	3.2186	3.1978	3.1951	
1 1/8-7	UNF	1.1643	1.1667	1.1997	1.1969	1.1731	1.178	1.168	4 1/2-12	UNF	3.4448	3.4421	3.4213	3.4186	3.3978	3.3951	
1 1/4-7	UNF	1.2643	1.2667	1.2997	1.2969	1.2731	1.278	1.268	5-12	UNF	3.6448	3.6421	3.6213	3.6186	3.5978	3.5951	
1 3/8-6	UNF	1.3643	1.3667	1.3997	1.3969	1.3731	1.378	1.368	5 1/2-12	UNF	3.8448	3.8421	3.8213	3.8186	3.7978	3.7951	
1 1/2-5	UNF	1.4643	1.4667	1.4997	1.4969	1.4731	1.478	1.468	6-12	UNF	4.0448	4.0421	4.0213	4.0186	3.9978	3.9951	
1 3/4-4 1/2	UNF	1.5643	1.5667	1.5997	1.5969	1.5731	1.578	1.568	6 1/2-12	UNF	4.2448	4.2421	4.2213	4.2186	4.1978	4.1951	
2-4	UNF	1.6643	1.6667	1.6997	1.6969	1.6731	1.678	1.668	7-12	UNF	4.4448	4.4421	4.4213	4.4186	4.3978	4.3951	
2 1/4-3 1/2	UNF	1.7643	1.7667	1.7997	1.7969	1.7731	1.778	1.768	7 1/2-12	UNF	4.6448	4.6421	4.6213	4.6186	4.5978	4.5951	
2 1/2-3	UNF	1.8643	1.8667	1.8997	1.8969	1.8731	1.878	1.868	8-12	UNF	4.8448	4.8421	4.8213	4.8186	4.7978	4.7951	
2 3/4-2 1/2	UNF	1.9643	1.9667	1.9997	1.9969	1.9731	1.978	1.968	8 1/2-12	UNF	5.0448	5.0421	5.0213	5.0186	4.9978	4.9951	
3-2	UNF	2.0643	2.0667	2.0997	2.0969	2.0731	2.078	2.068	9-12	UNF	5.2448	5.2421	5.2213	5.2186	5.1978	5.1951	
3 1/2-2	UNF	2.1643	2.1667	2.1997	2.1969	2.1731	2.178	2.168	9 1/2-12	UNF	5.4448	5.4421	5.4213	5.4186	5.3978	5.3951	
4-2	UNF	2.2643	2.2667	2.2997	2.2969	2.2731	2.278	2.268	10-12	UNF	5.6448	5.6421	5.6213	5.6186	5.5978	5.5951	
4 1/2-2	UNF	2.3643	2.3667	2.3997	2.3969	2.3731	2.378	2.368	10 1/2-12	UNF	5.8448	5.8421	5.8213	5.8186	5.7978	5.7951	
5-2	UNF	2.4643	2.4667	2.4997	2.4969	2.4731	2.478	2.468	11-12	UNF	6.0448	6.0421	6.0213	6.0186	5.9978	5.9951	
5 1/2-2	UNF	2.5643	2.5667	2.5997	2.5969	2.5731	2.578	2.568	11 1/2-12	UNF	6.2448	6.2421	6.2213	6.2186	6.1978	6.1951	
6-2	UNF	2.6643	2.6667	2.6997	2.6969	2.6731	2.678	2.668	12-12	UNF	6.4448	6.4421	6.4213	6.4186	6.3978	6.3951	
6 1/2-2	UNF	2.7643	2.7667	2.7997	2.7969	2.7731	2.778	2.768									
7-2	UNF	2.8643	2.8667	2.8997	2.8969	2.8731	2.878	2.868									
7 1/2-2	UNF	2.9643	2.9667	2.9997	2.9969	2.9731	2.978	2.968									
8-2	UNF	3.0643	3.0667	3.0997	3.0969	3.0731	3.078	3.068									
8 1/2-2	UNF	3.1643	3.1667	3.1997	3.1969	3.1731	3.178	3.168									
9-2	UNF	3.2643	3.2667	3.2997	3.2969	3.2731	3.278	3.268									
9 1/2-2	UNF	3.3643	3.3667	3.3997	3.3969	3.3731	3.378	3.368									
10-2	UNF	3.4643	3.4667	3.4997	3.4969	3.4731	3.478	3.468									
10 1/2-2	UNF	3.5643	3.5667	3.5997	3.5969	3.5731	3.578	3.568									
11-2	UNF	3.6643	3.6667	3.6997	3.6969	3.6731	3.678	3.668									
11 1/2-2	UNF	3.7643	3.7667	3.7997	3.7969	3.7731	3.778	3.768									
12-2	UNF	3.8643	3.8667	3.8997	3.8969	3.8731	3.878	3.868									
12 1/2-2	UNF	3.9643	3.9667	3.9997	3.9969	3.9731	3.978	3.968									
13-2	UNF	4.0643	4.0667	4.0997	4.0969	4.0731	4.078	4.068									
13 1/2-2	UNF	4.1643	4.1667	4.1997	4.1969	4.1731	4.178	4.168									
14-2	UNF	4.2643	4.2667	4.2997	4.2969	4.2731	4.278	4.268									
14 1/2-2	UNF	4.3643	4.3667	4.3997	4.3969	4.3731	4.378	4.368									
15-2	UNF	4.4643	4.4667	4.4997	4.4969	4.4731	4.478	4.468									
15 1/2-2	UNF	4.5643	4.5667	4.5997	4.5969	4.5731	4.578	4.568									
16-2	UNF	4.6643	4.6667	4.6997	4.6969	4.6731	4.678	4.668									
16 1/2-2	UNF	4.7643	4.7667	4.7997	4.7969	4.7731	4.778	4.768									
17-2	UNF	4.8643	4.8667	4.8997	4.8969	4.8731	4.878	4.868									
17 1/2-2	UNF	4.9643	4.9667	4.9997	4.9969	4.9731	4.978	4.968									
18-2	UNF	5.0643	5.0667	5.0997	5.0969	5.0731	5.078	5.068									
18 1/2-2	UNF	5.1643	5.1667	5.1997	5.1969	5.1731	5.178	5.168									
19-2	UNF	5.2643	5.2667	5.2997	5.2969	5.2731	5.278	5.268									
19 1/2-2	UNF	5.3643	5.3667	5.3997	5.3969	5.3731	5.378	5.368									
20-2	UNF	5.4643	5.4667	5.4997	5.4969	5.4731	5.478	5.468									
20 1/2-2	UNF	5.5643	5.5667	5.5997	5.5969	5.5731	5.578	5.568									
21-2	UNF	5.6643	5.6667	5.6997	5.6969	5.6731	5.678	5.668									
21 1/2-2	UNF	5.7643	5.7667	5.7997	5.7969	5.7731	5.778	5.768									
22-2	UNF	5.8643	5.8667	5.8997	5.8969	5.8731	5.878	5.868									
22 1/2-2	UNF	5.9643	5.9667	5.9997	5.9969	5.9731	5.978	5.968									
23-2	UNF	6.0643	6.0667	6.0997	6.0969	6.0731	6.078	6.068									
23 1/2-2	UNF	6.1643	6.1667	6.1997	6.1969	6.1731	6.178	6.168									
24-2	UNF	6.2643	6.2667	6.2997	6.2969	6.2731	6.278	6.268									
24 1/2-2	UNF	6.3643	6.3667	6.3997	6.3969	6.3731	6.378	6.368									
25-2	UNF	6.4643	6.4667	6.4997	6.4969	6.4731	6.478	6.468									
25 1/2-2	UNF	6.5643	6.5667	6.5997	6.5969	6.5731	6.578	6.568									
26-2	UNF	6.6643	6.6667	6.6997	6.6969	6.6731	6.678	6.668									
26 1/2-2	UNF	6.7643	6.7667	6.7997	6.7969	6.7731	6.778	6.768									
27-2	UNF	6.8643	6.8667	6.8997	6.8969	6.8731	6.878	6.868									
27 1/2-2	UNF	6.9643	6.9667	6.9997	6.9969	6.9731	6.978	6.968									
28-2	UNF	7.0643	7.0667	7.0997	7.0969	7.0731	7.078	7.068									
28 1/2-2	UNF	7.1643	7.1667	7.1997	7.1969	7.1731	7.178	7.168									
29-2	UNF	7.2643	7.2667	7.2997	7.2969	7.2731	7.278	7.268									
29 1/2-2	UNF	7.3643	7.3667	7.3997	7.3969	7.3731	7.378	7.368									
30-2	UNF	7.4643	7.4667	7.4997	7.4969	7.4731	7.478	7.468									
30 1/2-2	UNF	7.5643	7.5667	7.5997	7.5969	7.5731	7.578	7.568									
31-2	UNF	7.6643	7.6667	7.6997	7.6969	7.6731	7.678	7.668									
31 1/2-2	UNF	7.7643	7.7667	7.7997	7.7969	7.7731	7.778	7.768									
32-2	UNF	7.8643	7.8667	7.8997	7.8969	7.8731	7.878	7.868									
32 1/2-2	UNF	7.9643	7.9667	7.9997	7.9969	7.9731	7.978	7.968									
33-2	UNF	8.0643	8.0667	8.0997	8.0969	8.0731	8.078	8.068									
33 1/2-2	UNF	8.1643	8.1667	8.1997	8.1969	8.1731	8.178	8.168									
34-2	UNF	8.2643	8.2667	8.2997	8.2969	8.2731	8.278	8.268									
34 1/2-2	UNF																

the resulting amount equal to the sum of the nut pitch diameter tolerance and the nut minor diameter tolerance.

3.16 Pipe Threads—Pipe threads, unless there is specific authorization to the contrary, shall conform to the Dryseal American Standard Taper Pipe Thread (NPTF). At purchaser's option, the pipe thread on automotive tube fittings may be shortened in conformity with the SAE Short Dryseal Taper Pipe Thread (PTF-SAE Short). Specifications for pipe threads are given in detail in SAE J476.

The length of full form external thread shall not be shorter than L_0 , plus one pitch (thread) for Dryseal NPTF and L_0 for Dryseal PTF-SAE Short, except that where thread is cut through into a relieved body or undercut on the fitting, the minimum full thread length may be reduced by one pitch (thread).

Where external pipe threads are produced by roll threading, the diameter of the unthreaded portion of shank adjacent to shoulder may be reduced to the R_0 basic diameter.

The tube fitting dimensions tabulated herein are based on length of the Dryseal American Standard Taper Pipe Thread (NPTF), it being

the consensus of manufacturers and users that trouble-free assembly cannot be assured unless a full length is used. However, the tap drill depths and overall lengths specified in the tables for fittings with external taper pipe threads are not consistent with the tap drill depths and overall thread lengths of the Dryseal American Standard Taper Pipe Threads (NPTF) given in Table A2, Appendix A, of SAE J476. The full length Dryseal American Standard Taper Pipe Threads specified in Table A2 of SAE J476 cannot be used, as the tap drill depths and overall lengths of the fittings have been reduced to the minimum required by bottoming taps to produce standard full length thread. The dimensions described above are peculiar to these tube fittings and as special tooling is required, caution should be exercised in specifying such dimensions for any other products.

External pipe threads shall be chamfered from the diameters shown in Table 15 to produce the specified length of chamfered or partial thread. Internal pipe threads shall be chamfered 90 degrees, included angle, to the diameters shown in Table 15.

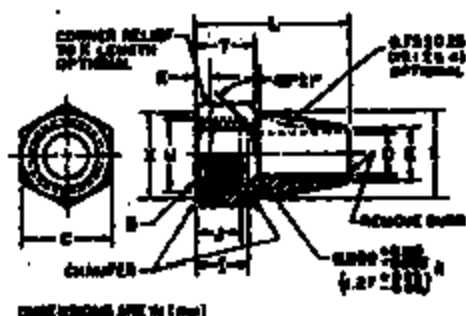


FIG. 4—FLARED TYPE NUTS
Ø10(11) SHORT NUT
Ø10(11) LONG NUT

TABLE 15—DIMENSIONS OF NUTS (PARTIAL)

Nom Tube OD, in	L, Nom Thread Sec. in Class 2B, int	C Max, in	Ø in		E Ø in		F		J Full Thread Ø in		K	
			in	mm	in	mm	in	mm	in	mm		
											+0.005 -0.000	+0.13 -0.00
1/8	3/16-24	3/8	0.130	3.30	0.20	5.1	0.22	5.6	0.10	2.5	0.00	0.0
1/4	7/16-20	7/16	0.192	4.88	0.31	7.9	0.29	7.1	0.22	5.6	0.00	0.0
3/8	1 1/8-18	1 1/8	0.312	7.92	0.38	9.7	0.34	8.6	0.28	7.1	0.12	3.0
1/2	1 1/4-14	1 1/4	0.442	11.22	0.56	14.3	0.44	11.2	0.40	10.2	0.12	3.0
3/4	1 3/8-12	1 3/8	0.688	17.48	0.82	20.8	0.68	17.3	0.60	15.2	0.12	3.0
1	1 7/8-10	1 7/8	1.000	25.40	1.18	30.0	0.98	25.0	0.80	20.3	0.12	3.0
1 1/8	2 1/8-8	2 1/8	1.625	41.27	1.80	45.7	1.40	35.5	1.10	27.9	0.12	3.0
1 1/4	2 1/4-8	2 1/4	1.625	41.27	1.80	45.7	1.40	35.5	1.10	27.9	0.12	3.0
1 1/2	2 1/2-7	2 1/2	1.875	47.63	2.05	52.1	1.60	40.6	1.30	33.0	0.12	3.0
1 3/4	2 3/4-6	2 3/4	2.125	54.0	2.30	58.4	1.80	45.7	1.40	35.5	0.12	3.0
2	3-5	3	2.375	60.3	2.55	64.8	2.00	50.8	1.60	40.6	0.12	3.0
2 1/4	3 1/4-4	3 1/4	2.625	66.7	2.80	71.1	2.20	55.9	1.80	45.7	0.12	3.0
2 1/2	3 1/2-4	3 1/2	2.625	66.7	2.80	71.1	2.20	55.9	1.80	45.7	0.12	3.0
2 3/4	3 3/4-4	3 3/4	2.875	73.0	3.05	77.5	2.40	60.9	2.00	50.8	0.12	3.0
3	4-4	4	3.125	79.2	3.30	83.8	2.60	66.0	2.20	55.9	0.12	3.0
3 1/4	4 1/4-3	4 1/4	3.375	85.7	3.55	90.2	2.80	71.1	2.40	60.9	0.12	3.0
3 1/2	4 1/2-3	4 1/2	3.375	85.7	3.55	90.2	2.80	71.1	2.40	60.9	0.12	3.0
3 3/4	4 3/4-3	4 3/4	3.625	92.1	3.80	96.5	3.00	76.2	2.60	66.0	0.12	3.0
4	5-3	5	3.875	98.4	4.05	102.9	3.20	81.3	2.80	71.1	0.12	3.0
4 1/4	5 1/4-2	5 1/4	4.125	104.8	4.30	109.3	3.40	86.4	3.00	76.2	0.12	3.0
4 1/2	5 1/2-2	5 1/2	4.125	104.8	4.30	109.3	3.40	86.4	3.00	76.2	0.12	3.0
4 3/4	5 3/4-2	5 3/4	4.375	111.1	4.55	115.6	3.60	91.4	3.20	81.3	0.12	3.0
5	6-2	6	4.625	117.5	4.80	121.9	3.80	96.5	3.40	86.4	0.12	3.0
5 1/4	6 1/4-2	6 1/4	4.875	123.8	5.05	128.3	4.00	101.6	3.60	91.4	0.12	3.0
5 1/2	6 1/2-2	6 1/2	4.875	123.8	5.05	128.3	4.00	101.6	3.60	91.4	0.12	3.0
5 3/4	6 3/4-2	6 3/4	5.125	130.2	5.30	134.6	4.20	106.7	3.80	96.5	0.12	3.0
6	7-2	7	5.375	136.5	5.55	140.9	4.40	111.8	4.00	101.6	0.12	3.0
6 1/4	7 1/4-2	7 1/4	5.625	142.9	5.80	147.3	4.60	116.9	4.20	106.7	0.12	3.0
6 1/2	7 1/2-2	7 1/2	5.625	142.9	5.80	147.3	4.60	116.9	4.20	106.7	0.12	3.0
6 3/4	7 3/4-2	7 3/4	5.875	149.3	6.05	153.7	4.80	121.9	4.40	111.8	0.12	3.0
7	8-2	8	6.125	155.7	6.30	160.0	5.00	127.0	4.60	116.9	0.12	3.0
7 1/4	8 1/4-2	8 1/4	6.375	162.1	6.55	166.4	5.20	132.1	4.80	121.9	0.12	3.0
7 1/2	8 1/2-2	8 1/2	6.375	162.1	6.55	166.4	5.20	132.1	4.80	121.9	0.12	3.0
7 3/4	8 3/4-2	8 3/4	6.625	168.4	6.80	172.8	5.40	137.2	5.00	127.0	0.12	3.0
8	9-2	9	6.875	174.8	7.05	179.2	5.60	142.3	5.20	132.1	0.12	3.0
8 1/4	9 1/4-2	9 1/4	7.125	181.1	7.30	185.5	5.80	147.4	5.40	137.2	0.12	3.0
8 1/2	9 1/2-2	9 1/2	7.125	181.1	7.30	185.5	5.80	147.4	5.40	137.2	0.12	3.0
8 3/4	9 3/4-2	9 3/4	7.375	187.5	7.55	191.9	6.00	152.5	5.60	142.3	0.12	3.0
9	10-2	10	7.625	193.8	7.80	198.2	6.20	157.6	5.80	147.4	0.12	3.0
9 1/4	10 1/4-2	10 1/4	7.875	200.2	8.05	204.6	6.40	162.7	6.00	152.5	0.12	3.0
9 1/2	10 1/2-2	10 1/2	7.875	200.2	8.05	204.6	6.40	162.7	6.00	152.5	0.12	3.0
9 3/4	10 3/4-2	10 3/4	8.125	206.5	8.30	210.9	6.60	167.8	6.20	157.6	0.12	3.0
10	11-2	11	8.375	212.9	8.55	217.3	6.80	172.9	6.40	162.7	0.12	3.0
10 1/4	11 1/4-2	11 1/4	8.625	219.2	8.80	223.7	7.00	178.0	6.60	167.8	0.12	3.0
10 1/2	11 1/2-2	11 1/2	8.625	219.2	8.80	223.7	7.00	178.0	6.60	167.8	0.12	3.0
10 3/4	11 3/4-2	11 3/4	8.875	225.6	9.05	230.1	7.20	183.1	6.80	172.9	0.12	3.0
11	12-2	12	9.125	231.9	9.30	236.4	7.40	188.2	7.00	178.0	0.12	3.0
11 1/4	12 1/4-2	12 1/4	9.375	238.3	9.55	242.8	7.60	193.3	7.20	183.1	0.12	3.0
11 1/2	12 1/2-2	12 1/2	9.375	238.3	9.55	242.8	7.60	193.3	7.20	183.1	0.12	3.0
11 3/4	12 3/4-2	12 3/4	9.625	244.7	9.80	249.2	7.80	198.4	7.40	188.2	0.12	3.0
12	13-2	13	9.875	251.1	10.05	255.6	8.00	203.5	7.60	193.3	0.12	3.0
12 1/4	13 1/4-2	13 1/4	10.125	257.5	10.30	261.9	8.20	208.6	7.80	198.4	0.12	3.0
12 1/2	13 1/2-2	13 1/2	10.125	257.5	10.30	261.9	8.20	208.6	7.80	198.4	0.12	3.0
12 3/4	13 3/4-2	13 3/4	10.375	263.8	10.55	268.3	8.40	213.7	8.00	203.5	0.12	3.0
13	14-2	14	10.625	270.2	10.80	274.7	8.60	218.8	8.20	208.6	0.12	3.0
13 1/4	14 1/4-2	14 1/4	10.875	276.6	11.05	281.1	8.80	223.9	8.40	213.7	0.12	3.0
13 1/2	14 1/2-2	14 1/2	10.875	276.6	11.05	281.1	8.80	223.9	8.40	213.7	0.12	3.0
13 3/4	14 3/4-2	14 3/4	11.125	282.9	11.30	287.5	9.00	229.0	8.60	218.8	0.12	3.0
14	15-2	15	11.375	289.3	11.55	293.9	9.20	234.1	8.80	223.9	0.12	3.0
14 1/4	15 1/4-2	15 1/4	11.625	295.7	11.80	300.3	9.40	239.2	9.00	229.0	0.12	3.0
14 1/2	15 1/2-2	15 1/2	11.625	295.7	11.80	300.3	9.40	239.2	9.00	229.0	0.12	3.0
14 3/4	15 3/4-2	15 3/4	11.875	302.1	12.05	306.7	9.60	244.3	9.20	234.1	0.12	3.0
15	16-2	16	12.125	308.5	12.30	313.1	9.80	249.4	9.40	239.2	0.12	3.0
15 1/4	16 1/4-2	16 1/4	12.375	314.9	12.55	319.5	10.00	254.5	9.60	244.3	0.12	3.0
15 1/2	16 1/2-2	16 1/2	12.375	314.9	12.55	319.5	10.00	254.5	9.60	244.3	0.12	3.0
15 3/4	16 3/4-2	16 3/4	12.625	321.3	12.80	325.9	10.20	259.6	9.80	249.4	0.12	3.0
16	17-2	17	12.875	327.7	13.05	332.3	10.40	264.7	10.00	254.5	0.12	3.0
16 1/4	17 1/4-2	17 1/4	13.125	334.1	13.30	338.7	10.60	269.8	10.20	259.6	0.12	3.0
16 1/2	17 1/2-2	17 1/2	13.125	334.1	13.30	338.7	10.60	269.8	10.20	259.6	0.12	3.0
16 3/4	17 3/4-2	17 3/4	13.375	340.5	13.55	345.1	10.80	274.9	10.40	264.7	0.12	3.0
17	18-2	18	13.625	346.9	13.80	351.5	11.00	280.0	10.60	269.8	0.12	3.0
17 1/4	18 1/4-2	18 1/4	13.875	353.3	14.05	357.9	11.20	285.1	10.80	274.9	0.12	3.0
17 1/2	18 1/2-2	18 1/2	13.875	353.3	14.05	357.9	11.20	285.1	10.80	274.9	0.12	3.0
17 3/4	18 3/4-2	18 3/4	14.125	359.7	14.30	364.3	11.40	290.2	11.00	280.0	0.12	3.0
18	19-2	19	14.375	366.1	14.55	370.7	11.60	295.3	11.20	285.1	0.12	3.0
18 1/4	19 1/4-2	19 1/4	14.625	372.5	14.80	377.1	11.80	300.4	11.40	290.2	0.12	3.0
18 1/2	19 1/2-2	19 1/2	14.625	372.5	14.80	377.1	11.80	300.4	11.40	290.2	0.12	3.0
18 3/4	19 3/4-2	19 3/4	14.875	378.9	15.05	383.5	12.00	305.5	11.60	295.3	0.12	3.0
19	20-2	20	15.125	385.3	15.30	389.9	12.20	310.6	11.80	300.4	0.12	3.0
19 1/4	20 1/4-2	20 1/4	15.375	391.7	15.55	396.3	12.40	315.7	12.00	305.5	0.12	3.0
19 1/2	20 1/2-2	20 1/2	15.375	391.7	15.55	396.3	12.40	315.7	12.00	305.5	0.12	3.0
19 3/4	20 3/4-2	20 3/4	15.625	398.1	15.80	402.7	12.60	320.8	12.20	310.6	0.12	3.0
20	21-2	21	15.875	404.5	16.05	409.1	12.80	325.9	12.40	315.7	0.12	3.0
20 1/4	21 1/4-2	21 1/4	16.125	410.9	16.30	415.5	13.00	331.0	12.60	320.8	0.12	3.0
20 1/2	21 1/2-2	21 1/2	16.125	410.9	16.30	415.5	13.00	331.0	12.60	320.8	0.12	3.0
20 3/4	21 3/4-2	21 3/4	16.375	417.3	16.55	421.9	13.20	336.1	12.80	325.9	0.12	3.0
21	22-2	22	16.625	423.7	16.80	428.3	13.40	341.2	13.00	331.0	0.12	3.0
21 1/4	22 1/4-2	22 1/4	16.875	430.1	17.05	434.7	13.60	346.3	13.20	336.1	0.12	3.0
21 1/2	22 1/2-2	22 1/2	16.875	430.1	17.05	434.7	13.60	346.3	13.20	336.1	0.12	3.0
21 3/4	22 3/4-2	22 3/4	17.125	436.5	17.30	441.1	13.80	351.4	13.40	341.2	0.12	3.0
22	23-2	23	17.375	442.9	17.55	447.5	14.00	356.5	13.60	346.3	0.12	3.0
22 1/4	23 1/4-2	23 1/4	17.625	449.3	17.80	453.9	14.20	361.6	13.80	351.4	0.12	3.0
22 1/2	23 1/2-2	23 1/2	17.625	449.3	17.80	453.9	14.20	361.6	13.80	351.4	0.12	3.0
22 3/4	23 3/4-2	23 3/4	17.875	455.7	18.05	460.3	14.40	366.7	14.			

TABLE 6—DIMENSIONS OF CONNECTIONS, LUGS, BARS, AND THE STUDS AS TO JOE

Nominal Size, in.	A Overall Depth, in.	B, Nominal Depth, in. Class 20, in.	C Nom. in.		C ₁ Nom. in.		C ₂ Nom. in.		D Nom. in.		E Nom. in.		F Nom. in.		G Nom. in.		H Nom. in.	
			Beam	Steel	Beam	Steel	Beam	Steel	in	mm	in	mm	in	mm	in	mm	in	mm
1/8	1/8	5/16-20	13/32	7/16	1/2	1/2	1/2	1/2	0.070	1.78	0.110	2.79	0.125	3.17	0.210	5.30	0.310	7.87
3/16	3/16	3/8-24	13/32	1/2	1/2	1/2	1/2	1/2	0.125	3.17	0.125	3.17	0.125	3.17	0.210	5.30	0.310	7.87
1/4	1/4	7/16-24	17/32	9/16	17/32	9/16	9/16	9/16	0.180	4.57	0.175	4.43	0.180	4.57	0.210	5.30	0.310	7.87
5/16	5/16	1/2-20	19/32	5/8	19/32	5/8	5/8	5/8	0.210	5.30	0.210	5.30	0.210	5.30	0.210	5.30	0.310	7.87
3/8	3/8	1/2-20	19/32	5/8	11/16	11/16	5/8	5/8	0.210	5.30	0.210	5.30	0.210	5.30	0.210	5.30	0.310	7.87
1/2	1/2	3/4-16	3/4	3/4	3/4	3/4	3/4	3/4	0.281	7.14	0.281	7.14	0.281	7.14	0.281	7.14	0.310	7.87
5/8	5/8	11/16-18	13/16	13/16	13/16	13/16	13/16	13/16	0.300	7.62	0.300	7.62	0.300	7.62	0.300	7.62	0.310	7.87
3/4	3/4	3/4-16	3/4	3/4	3/4	3/4	3/4	3/4	0.300	7.62	0.300	7.62	0.300	7.62	0.300	7.62	0.310	7.87
7/8	7/8	7/8-15	1-1/8	1-1/8	1-1/8	1-1/8	1-1/8	1-1/8	0.375	9.53	0.375	9.53	0.375	9.53	0.375	9.53	0.310	7.87
1	1	1-1/8-15	1-1/8	1-1/8	1-1/8	1-1/8	1-1/8	1-1/8	0.375	9.53	0.375	9.53	0.375	9.53	0.375	9.53	0.310	7.87
Nominal Size, in.	D ₁ Nom. in.		D ₂ Nom. in.		D ₃ Nom. in.		E Nom. in.				F Nom. in.				G Nom. in.			
	in		in		in		in		in		in		in		in		in	
	mm		mm		mm		mm		mm		mm		mm		mm		mm	
1/8	0.380	9.65	0.380	9.65	0.380	9.65	0.100	2.54	0.100	2.54	0.100	2.54	0.100	2.54	0.100	2.54	0.100	2.54
3/16	0.380	9.65	0.380	9.65	0.380	9.65	0.100	2.54	0.100	2.54	0.100	2.54	0.100	2.54	0.100	2.54	0.100	2.54
1/4	0.380	9.65	0.380	9.65	0.380	9.65	0.100	2.54	0.100	2.54	0.100	2.54	0.100	2.54	0.100	2.54	0.100	2.54
5/16	0.380	9.65	0.380	9.65	0.380	9.65	0.100	2.54	0.100	2.54	0.100	2.54	0.100	2.54	0.100	2.54	0.100	2.54
3/8	0.380	9.65	0.380	9.65	0.380	9.65	0.100	2.54	0.100	2.54	0.100	2.54	0.100	2.54	0.100	2.54	0.100	2.54
1/2	0.469	11.91	0.469	11.91	0.469	11.91	0.100	2.54	0.100	2.54	0.100	2.54	0.100	2.54	0.100	2.54	0.100	2.54
5/8	0.469	11.91	0.469	11.91	0.469	11.91	0.100	2.54	0.100	2.54	0.100	2.54	0.100	2.54	0.100	2.54	0.100	2.54
3/4	0.508	12.90	0.508	12.90	0.508	12.90	0.100	2.54	0.100	2.54	0.100	2.54	0.100	2.54	0.100	2.54	0.100	2.54
Nominal Size, in.	F and Full Thread Max.		G Nom. in.		H Nom. in.		I Nom. in.		J Nom. in.		K Nom. in.		L Nom. in.		M Nom. in.		N Nom. in.	
	in		in		in		in		in		in		in		in		in	
	mm		mm		mm		mm		mm		mm		mm		mm		mm	
1/8	0.011	0.28	0.187	4.75	0.02	0.51	0.02	0.51	0.02	0.51	0.02	0.51	0.02	0.51	0.02	0.51	0.02	0.51
3/16	0.015	0.38	0.200	5.08	0.02	0.51	0.02	0.51	0.02	0.51	0.02	0.51	0.02	0.51	0.02	0.51	0.02	0.51
1/4	0.020	0.51	0.250	6.35	0.02	0.51	0.02	0.51	0.02	0.51	0.02	0.51	0.02	0.51	0.02	0.51	0.02	0.51
5/16	0.025	0.64	0.275	7.00	0.02	0.51	0.02	0.51	0.02	0.51	0.02	0.51	0.02	0.51	0.02	0.51	0.02	0.51
3/8	0.030	0.76	0.300	7.62	0.02	0.51	0.02	0.51	0.02	0.51	0.02	0.51	0.02	0.51	0.02	0.51	0.02	0.51
1/2	0.035	0.89	0.325	8.26	0.02	0.51	0.02	0.51	0.02	0.51	0.02	0.51	0.02	0.51	0.02	0.51	0.02	0.51
5/8	0.041	1.04	0.350	8.89	0.02	0.51	0.02	0.51	0.02	0.51	0.02	0.51	0.02	0.51	0.02	0.51	0.02	0.51
3/4	0.046	1.17	0.375	9.53	0.02	0.51	0.02	0.51	0.02	0.51	0.02	0.51	0.02	0.51	0.02	0.51	0.02	0.51
Nominal Size, in.	L ₁ Nom. in.		L ₂ Nom. in.		L ₃ Nom. in.		L ₄ Nom. in.		L ₅ Nom. in.		L ₆ Nom. in.		L ₇ Nom. in.		L ₈ Nom. in.		L ₉ Nom. in.	
	in		in		in		in		in		in		in		in		in	
	mm		mm		mm		mm		mm		mm		mm		mm		mm	
1/8	—	—	0.01	0.25	0.01	0.25	0.01	0.25	0.01	0.25	0.01	0.25	0.01	0.25	0.01	0.25	0.01	0.25
3/16	—	—	0.01	0.25	0.01	0.25	0.01	0.25	0.01	0.25	0.01	0.25	0.01	0.25	0.01	0.25	0.01	0.25
1/4	0.01	0.25	0.01	0.25	0.01	0.25	0.01	0.25	0.01	0.25	0.01	0.25	0.01	0.25	0.01	0.25	0.01	0.25
5/16	0.01	0.25	0.01	0.25	0.01	0.25	0.01	0.25	0.01	0.25	0.01	0.25	0.01	0.25	0.01	0.25	0.01	0.25
3/8	0.01	0.25	0.01	0.25	0.01	0.25	0.01	0.25	0.01	0.25	0.01	0.25	0.01	0.25	0.01	0.25	0.01	0.25
1/2	0.01	0.25	0.01	0.25	0.01	0.25	0.01	0.25	0.01	0.25	0.01	0.25	0.01	0.25	0.01	0.25	0.01	0.25
5/8	0.01	0.25	0.01	0.25	0.01	0.25	0.01	0.25	0.01	0.25	0.01	0.25	0.01	0.25	0.01	0.25	0.01	0.25
3/4	0.01	0.25	0.01	0.25	0.01	0.25	0.01	0.25	0.01	0.25	0.01	0.25	0.01	0.25	0.01	0.25	0.01	0.25

(Table continued on next page)

TABLE 4—DIMENSIONS OF CONNECTIONS, UNIONS, ELBOWS, AND TEES FROM SA TO 70 IN NOMINAL SIZE

Nominal Tube OD, in	M		M ₁		M ₂		M ₃		M ₄		M ₅		M ₆		M ₇		M ₈	
	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm
1/8	0.37	9.4	0.33	8.4	0.33	8.4	0.47	11.9	0.53	13.3	0.39	9.9	0.36	9.1	0.36	9.1	0.36	9.1
3/16	0.37	9.4	0.33	8.4	0.33	8.4	0.47	11.9	0.53	13.3	0.39	9.9	0.36	9.1	0.36	9.1	0.36	9.1
1/4	0.37	9.4	0.33	8.4	0.33	8.4	0.47	11.9	0.53	13.3	0.39	9.9	0.36	9.1	0.36	9.1	0.36	9.1
5/16	0.47	11.9	0.34	8.6	0.43	10.9	0.43	10.9	0.36	9.1	0.36	9.1	0.36	9.1	0.36	9.1	0.36	9.1
3/8	0.47	11.9	0.34	8.6	0.43	10.9	0.43	10.9	0.36	9.1	0.36	9.1	0.36	9.1	0.36	9.1	0.36	9.1
7/16	0.53	13.3	0.36	9.1	0.36	9.1	0.36	9.1	0.36	9.1	0.36	9.1	0.36	9.1	0.36	9.1	0.36	9.1
1/2	0.53	13.3	0.36	9.1	0.36	9.1	0.36	9.1	0.36	9.1	0.36	9.1	0.36	9.1	0.36	9.1	0.36	9.1
5/8	0.53	13.3	0.36	9.1	0.36	9.1	0.36	9.1	0.36	9.1	0.36	9.1	0.36	9.1	0.36	9.1	0.36	9.1
3/4	0.53	13.3	0.36	9.1	0.36	9.1	0.36	9.1	0.36	9.1	0.36	9.1	0.36	9.1	0.36	9.1	0.36	9.1
Nominal Tube OD, in	P		P ₁		P ₂		P ₃		P ₄		P ₅		P ₆		P ₇		P ₈	
	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm
1/8	0.19	4.8	0.093	2.36	0.093	2.36	0.36	9.1	0.36	9.1	0.36	9.1	0.36	9.1	0.36	9.1	0.36	9.1
3/16	0.25	6.4	0.093	2.36	0.093	2.36	0.36	9.1	0.36	9.1	0.36	9.1	0.36	9.1	0.36	9.1	0.36	9.1
1/4	0.25	6.4	0.093	2.36	0.093	2.36	0.36	9.1	0.36	9.1	0.36	9.1	0.36	9.1	0.36	9.1	0.36	9.1
5/16	0.25	6.4	0.093	2.36	0.093	2.36	0.36	9.1	0.36	9.1	0.36	9.1	0.36	9.1	0.36	9.1	0.36	9.1
3/8	0.25	6.4	0.093	2.36	0.093	2.36	0.36	9.1	0.36	9.1	0.36	9.1	0.36	9.1	0.36	9.1	0.36	9.1
7/16	0.25	6.4	0.093	2.36	0.093	2.36	0.36	9.1	0.36	9.1	0.36	9.1	0.36	9.1	0.36	9.1	0.36	9.1
1/2	0.25	6.4	0.093	2.36	0.093	2.36	0.36	9.1	0.36	9.1	0.36	9.1	0.36	9.1	0.36	9.1	0.36	9.1
5/8	0.25	6.4	0.093	2.36	0.093	2.36	0.36	9.1	0.36	9.1	0.36	9.1	0.36	9.1	0.36	9.1	0.36	9.1
3/4	0.25	6.4	0.093	2.36	0.093	2.36	0.36	9.1	0.36	9.1	0.36	9.1	0.36	9.1	0.36	9.1	0.36	9.1
Nominal Tube OD, in	K		K ₁		K ₂		K ₃		K ₄		K ₅		K ₆		K ₇		K ₈	
	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm
1/8	0.44	11.2	0.41	10.4	0.41	10.4	0.36	9.1	0.36	9.1	0.36	9.1	0.36	9.1	0.36	9.1	0.36	9.1
3/16	0.47	11.9	0.47	11.9	0.47	11.9	0.36	9.1	0.36	9.1	0.36	9.1	0.36	9.1	0.36	9.1	0.36	9.1
1/4	0.53	13.3	0.53	13.3	0.53	13.3	0.36	9.1	0.36	9.1	0.36	9.1	0.36	9.1	0.36	9.1	0.36	9.1
5/16	0.59	15.0	0.59	15.0	0.59	15.0	0.36	9.1	0.36	9.1	0.36	9.1	0.36	9.1	0.36	9.1	0.36	9.1
3/8	0.59	15.0	0.59	15.0	0.59	15.0	0.36	9.1	0.36	9.1	0.36	9.1	0.36	9.1	0.36	9.1	0.36	9.1
7/16	0.75	19.1	0.75	19.1	0.75	19.1	0.36	9.1	0.36	9.1	0.36	9.1	0.36	9.1	0.36	9.1	0.36	9.1
1/2	0.84	21.3	0.75	19.1	0.81	20.6	0.81	20.6	0.81	20.6	0.81	20.6	0.81	20.6	0.81	20.6	0.81	20.6
5/8	0.91	23.1	0.86	21.8	0.91	23.1	0.91	23.1	0.91	23.1	0.91	23.1	0.91	23.1	0.91	23.1	0.91	23.1
3/4	1.00	25.4	1.00	25.4	1.00	25.4	1.00	25.4	1.00	25.4	1.00	25.4	1.00	25.4	1.00	25.4	1.00	25.4

* Based on American Standard Taper Pipe Thread, See General Specifications.

† Where SAE Short Pipe Thread is authorized by purchaser, dimensions L₁, L₂, L₃, L₄, L₅, L₆, L₇, L₈, and L₉ are reduced by proportionate reduction of pipe thread length. See SAE J308, Tables 1 and 2.

‡ Top drill depth given applies to all ball-bearing taps to produce standard full thread length. For tapered top chamfers, see tapered Taper Pipe Thread in General Specifications.

§ Class 2B surface finish shall apply to upper alloy fittings and Class 20 surface finish shall apply to steel fittings.

¶ End full thread is measured from face of nut to last full thread of upper diameter.

‡ End full thread is measured from face of nut to last full thread of upper diameter.

2.11 Material and Manufacture.—All types of automotive tube fittings shall be made from brass or steel as specified by the purchaser and, at manufacturer's option and in accordance with the process of manufacture, may be milled from the bar or forged. Brass shall be UNS C36000 (half-hard), UNS C34500, or UNS C35000 for bar or extruded stock and UNS C37700 for forgings.

2.12 Finish.—Unless otherwise specified by the purchaser, steel fittings shall be furnished cadmium or zinc plated to a thickness of 0.0002 to 0.0005 mm minimum. These parts must meet the requirements of a 5B salt spray test in accordance with ASTM B 117. At manufacturer's option, plated fittings may be given a subsequent chromate treatment.

2.13 Workmanship.—Workmanship shall conform to the best commercial practice to produce high quality fittings. Fittings shall be free from all hanging burrs, loose scale, and defects which might become lodged in seats and all other defects which might affect their serviceability. All mating surfaces must be smooth except the annular seat marks up to 100 µin (2.5 µm) maximum shall be permissible.

2.14 Assembly Considerations.—Where it is not of practicality from a function or production standpoint, the use of a compatible lubricant or sealant may be desirable in assembling Federal pipe thread on automotive tube fittings to minimize galling and effect a pressure-tight seal.

TABLE 6A—DIMENSIONS OF SPECIAL SIZE CONNECTORS (PAGE 6A) AND (PAGE 6B)

Nominal Size, in.	A, Dry End Thread, in.	B, Nominal Thread, in.	C, Nominal, in.	D, in.		E, in.		F, in.		G, in.		H, in.		I, in.		J, in.		K, in.	
				in.	mm.	in.	mm.	in.	mm.	in.	mm.	in.	mm.	in.	mm.	in.	mm.	in.	mm.
1/4	1/4	7/16-24	9/16	0.188	4.78	0.188	4.78	0.312	7.93	0.364	9.24	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3/8	3/8	7/8-18	3/4	0.375	9.53	0.375	9.53	0.312	7.93	0.364	9.24	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1/2	1/2	1-14	3/4	0.625	15.88	0.625	15.88	0.312	7.93	0.364	9.24	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3/4	3/4	1-1/2-12	1-1/4	0.875	22.38	0.875	22.38	0.312	7.93	0.364	9.24	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1	1	1-3/4-10	1-1/2	1.125	28.58	1.125	28.58	0.312	7.93	0.364	9.24	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1 1/4	1 1/4	2-4	1-3/4	1.625	41.28	1.625	41.28	0.312	7.93	0.364	9.24	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1 1/2	1 1/2	2-1/2-8	1-3/4	1.875	47.63	1.875	47.63	0.312	7.93	0.364	9.24	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2	2	2-1/2-8	1-3/4	2.125	54.00	2.125	54.00	0.312	7.93	0.364	9.24	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2 1/4	2 1/4	2-3/4-8	1-3/4	2.375	60.33	2.375	60.33	0.312	7.93	0.364	9.24	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Minimum hole and containing the largest group.

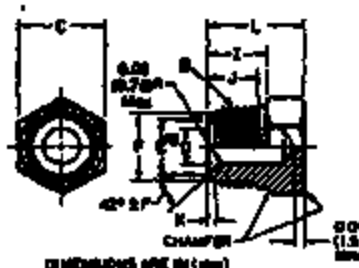


FIG. 8—INVERTED FLARE PLUG (040109)

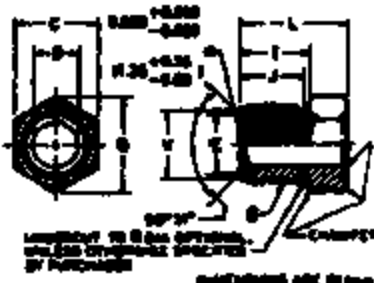


FIG. 9—INVERTED FLARE NUT (040110)

TABLE 7—DIMENSIONS OF FLARE PLUGS (04)

Nominal Size, in.	A, Nominal Thread, in.	B, Nominal Thread, in.	D, in.		E, in.		F, in.		G, in.		H, in.		I, in.		J, in.		K, in.	
			in.	mm.	in.	mm.	in.	mm.	in.	mm.	in.	mm.	in.	mm.	in.	mm.	in.	mm.
1/4	3/8-24	7/8	0.188	4.78	0.312	7.93	0.364	9.24	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1/4	7/16-24	7/8	0.188	4.78	0.312	7.93	0.364	9.24	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3/8	1/2-20	1	0.375	9.53	0.625	15.88	0.625	15.88	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1/2	3/4-16	1 1/4	0.625	15.88	0.875	22.38	0.875	22.38	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3/4	1-12	1 3/4	0.875	22.38	1.125	28.58	1.125	28.58	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1	1 1/4-10	2	1.125	28.58	1.375	34.93	1.375	34.93	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1 1/4	1 3/4-8	2 1/4	1.625	41.28	1.875	47.63	1.875	47.63	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1 1/2	2-8	2 1/2	1.875	47.63	2.125	54.00	2.125	54.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2	2-8	2 3/4	2.125	54.00	2.375	60.33	2.375	60.33	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

TABLE 8--CONTINUATION OF PARTS FROM 6

Nom Tube OD, in	A, Steel Thread Size, in Class 3A, (in)	C		D		E		F		G		H		I		J		K		L		M		N		O			
		in	mm	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm		
		+0.005 -0.005	+0.13 -0.08	+0.005 -0.005	+0.13 -0.08	+0.004 -0.004	+0.10 -0.08	+0.005 -0.005	+0.09 -0.11	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm
1/8	5/16-28	0.307	7.80	0.130	3.30	0.221	5.61	0.259	6.58	0.31	7.92	0.36	9.14	0.41	10.41	0.46	11.68	0.51	12.95	0.56	14.22	0.61	15.49	0.66	16.76	0.71	18.03	0.76	19.30
3/16	5/8-24	0.370	9.40	0.194	4.92	0.299	7.59	0.347	8.84	0.40	10.16	0.46	11.68	0.51	12.95	0.56	14.22	0.61	15.49	0.66	16.76	0.71	18.03	0.76	19.30	0.81	20.57	0.86	21.84
1/4	7/16-24	0.423	10.74	0.227	5.82	0.331	8.41	0.379	9.65	0.43	10.92	0.49	12.44	0.54	13.71	0.59	14.98	0.64	16.25	0.69	17.52	0.74	18.79	0.79	20.06	0.84	21.33	0.89	22.60
5/16	1/2-20	0.495	12.57	0.319	8.10	0.393	9.96	0.471	11.95	0.55	13.95	0.63	16.01	0.71	18.03	0.79	20.06	0.87	22.12	0.95	24.18	1.03	26.24	1.11	28.30	1.19	30.36	1.27	32.42
3/8	5/8-18	0.620	15.75	0.382	9.70	0.487	12.37	0.563	14.29	0.65	16.51	0.74	18.79	0.83	21.07	0.92	23.35	1.01	25.63	1.10	27.91	1.19	30.19	1.28	32.47	1.37	34.75	1.46	37.03
7/16	1 1/16-18	0.683	17.36	0.443	11.26	0.550	13.97	0.626	15.92	0.72	18.29	0.81	20.57	0.90	22.85	0.99	25.13	1.08	27.41	1.17	29.69	1.26	31.97	1.35	34.25	1.44	36.53	1.53	38.81
1/2	3/4-18	0.745	18.92	0.504	12.80	0.613	15.57	0.689	17.50	0.79	20.06	0.88	22.60	0.97	24.88	1.06	27.16	1.15	29.44	1.24	31.72	1.33	33.99	1.42	36.25	1.51	38.51	1.60	40.78
5/8	7/8-18	0.870	22.15	0.621	15.77	0.737	18.71	0.795	20.16	0.91	23.11	1.01	25.65	1.11	28.19	1.21	30.73	1.31	33.27	1.41	35.81	1.51	38.35	1.61	40.89	1.71	43.43	1.81	45.97
3/4	1 1/8-16	1.007	25.57	0.759	19.28	0.904	23.01	0.971	24.66	1.10	27.94	1.21	30.73	1.31	33.52	1.41	36.31	1.51	39.10	1.61	41.89	1.71	44.68	1.81	47.47	1.91	50.26	2.01	53.05

*On 3/8, 1/4, 5/16, and 3/8 in diam tube, the minimum hole diameter limits may be assembled at the hexagon end and the hole slightly tapered to a depth not exceeding 0.10 in (2.5 mm) before the hexagon end. A slight back of the hole must not be objectionable provided the minimum hole diameter limits are maintained. A chamfer rounding at the edge of the hole and a slight rounding of hexagon corners shall also be provided provided the hole meets the Working Test requirements in Table 8A.

*Included values apply only to cold formed steel and steel made from steel bar stock. Limits for other materials are made from bar stock and surface with appropriate tolerances on the bar stock.

*Hole diameter G and H may also be compared with thread pitch diameter within 0.01 in (0.25 mm) for all tolerances except F.

TABLE 8A--WORKING TEST REQUIREMENTS

Nom Tube OD, in	Torque Requirements for Steel Hex		Wrench Opening Size	
	lb-in	kg-m	in	mm
1/8	40	4.5	0.125	3.18
3/16	120	13.6	0.254	6.45
1/4	180	20.3	0.344	8.75
5/16	180	20.3	0.344	8.75
3/8	310	35.2	0.434	11.03
7/16	380	42.9	0.509	12.92
1/2	480	54.2	0.590	14.98
5/8	580	65.5	0.680	17.27
3/4	630	71.1	0.737	18.71

1.15 Working Test—Steel nuts when assembled without using two mating brass fittings which are held securely by a suitable means, such as in a vise, shall be capable of being separated by means of a standard open end wrench, having an opening as tabulated to the minimum torque values specified without failure (rounding) of the hexagon corners.

NOTE: The minimum torque requirements should not in any case be substituted as being installation torques. They are intended solely for determining the adequacy of the hexagon corners. (See Table 8A)

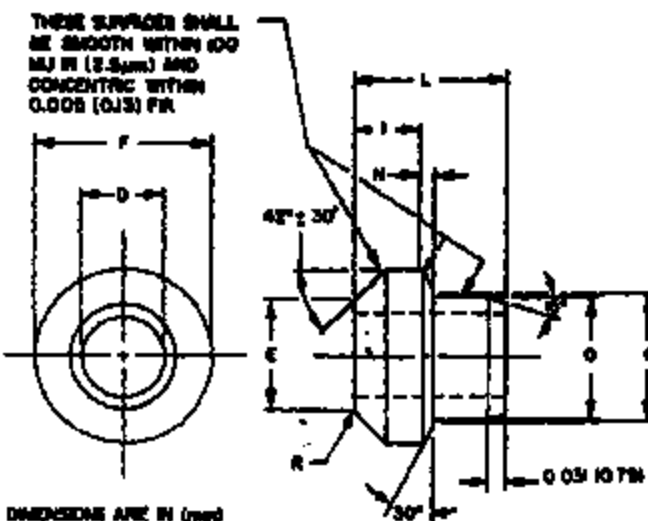


FIG. 10--SEAT INSERT (940141)

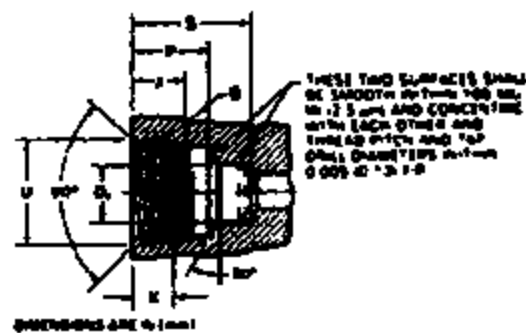


FIG. 11--DETAIL OF SEAT ASSEMBLY

TABLE 5A--DIMENSIONS OF TYPE A DIVIDED FLANGES FOR SLAT BEAMS AND SLAT BOLTS* NUMBER 10 AND 12

Nom Slat Bolt in	S, Flange Thread Bolt, in Class 2B, Int.	D in				G in		H in		I in	
		Min		Max		in	mm	in	mm	in	mm
		in	mm	in	mm						
1/8	3/16-32	0.075	1.91	0.081	2.06	0.161	4.09	0.088	2.24	0.164	4.17
3/16	3/8-24	0.152	3.84	0.158	4.01	0.313	7.91	0.165	4.19	0.321	8.18
1/4	7/16-24	0.164	4.17	0.169	4.29	0.372	9.47	0.210	5.34	0.383	9.73
5/16	1/2-20	0.315	8.00	0.321	8.16	0.392	9.95	0.298	7.58	0.428	10.88
3/8	5/8-18	0.375	9.53	0.384	9.75	0.489	12.42	0.345	8.76	0.514	13.06
7/16	1 1/16-12	0.438	11.13	0.448	11.37	0.602	15.30	0.409	10.39	0.610	15.49
1/2	3/4-12	0.488	12.40	0.499	12.67	0.681	17.29	0.471	11.96	0.679	17.25
5/8	7/8-12	0.538	13.67	0.549	13.94	0.732	18.58	0.506	12.84	0.734	18.65
3/4	1 1/8-10	0.621	15.77	0.632	16.04	0.778	19.76	0.578	14.69	0.801	20.34

Nom Slat Bolt in	N in				I in		J in		K in		L in		M in	
	Min		Max		in	mm	in	mm	in	mm	in	mm	in	mm
	in	mm	in	mm										
1/8	0.015	0.38	0.009	0.23	0.104	2.67	0.014	0.35	0.107	2.71	0.20	5.08	0.104	2.64
3/16	0.014	0.35	0.009	0.23	0.103	2.62	0.013	0.33	0.106	2.69	0.20	5.08	0.103	2.62
1/4	0.013	0.33	0.008	0.20	0.101	2.56	0.012	0.30	0.105	2.67	0.20	5.08	0.102	2.59
5/16	0.012	0.30	0.007	0.18	0.100	2.54	0.011	0.28	0.104	2.64	0.20	5.08	0.101	2.57
3/8	0.010	0.25	0.006	0.15	0.107	2.69	0.009	0.23	0.106	2.69	0.20	5.08	0.100	2.54
7/16	0.009	0.23	0.005	0.13	0.107	2.69	0.008	0.20	0.106	2.69	0.20	5.08	0.099	2.51
1/2	0.008	0.20	0.004	0.10	0.106	2.67	0.007	0.18	0.105	2.67	0.20	5.08	0.098	2.49
5/8	0.007	0.18	0.003	0.08	0.105	2.67	0.006	0.15	0.104	2.64	0.20	5.08	0.097	2.47
3/4	0.006	0.15	0.002	0.05	0.104	2.64	0.005	0.13	0.103	2.62	0.20	5.08	0.096	2.44

Nom Slat Bolt in	F in		G in		H in		I in		J in		K in	
	Min		Max		Min		Max		Min		Max	
	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm
1/8	0.020	0.51	0.160	4.06	0.006	0.15	0.00	0.00	0.02	0.51	0.02	0.51
3/16	0.018	0.46	0.150	3.81	0.005	0.13	0.00	0.00	0.02	0.51	0.02	0.51
1/4	0.016	0.41	0.140	3.55	0.004	0.10	0.00	0.00	0.02	0.51	0.02	0.51
5/16	0.014	0.35	0.130	3.30	0.003	0.08	0.00	0.00	0.02	0.51	0.02	0.51
3/8	0.012	0.30	0.120	3.05	0.002	0.05	0.00	0.00	0.02	0.51	0.02	0.51
7/16	0.010	0.25	0.110	2.80	0.001	0.03	0.00	0.00	0.02	0.51	0.02	0.51
1/2	0.008	0.20	0.100	2.54	0.000	0.00	0.00	0.00	0.02	0.51	0.02	0.51
5/8	0.006	0.15	0.090	2.29	0.000	0.00	0.00	0.00	0.02	0.51	0.02	0.51
3/4	0.005	0.13	0.080	2.03	0.000	0.00	0.00	0.00	0.02	0.51	0.02	0.51

*Type A nut inserts are intended for general purpose applications in cast or mild steel iron and steel.

Where standard inserts are specified into other materials, modification of nut may be necessary to insure proper installation.

TABLE 10—DIMENSIONS OF TYPE B SWAGED FLARED TUBE SEAL ADAPTERS AND SEAL BEARS* FIGURES 10 AND 11

Nom Tube OD, in	B, Nom Thread Pts, 60° Class 2B, 1st	B		B ₁		P		F			
		in		in		in		in		in	
		in	mm	in	mm	in	mm	in	mm	in	mm
3/16 1/4	3/8 -36 7/16 -34	0.303 0.304	7.70 7.74	0.100 0.100	2.54 2.59	0.125 0.127	3.18 3.23	0.317 0.320	8.00 8.08	0.300 0.305	7.62 7.75

Nom Tube OD, in	H		I		J		K				L	
	in		in		in		in		in		in	
	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm
3/16 1/4	0.317 0.320	8.00 8.08	0.100 0.100	2.54 2.59	0.125 0.127	3.18 3.23	0.317 0.320	8.00 8.08	0.300 0.305	7.62 7.75	0.300 0.305	7.62 7.75

Nom Tube OD, in	O		P		Q		R		S		T	
	in		in		in		in		in		in	
	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm
3/16 1/4	0.191 0.191	4.85 4.90	0.100 0.100	2.54 2.59	0.125 0.127	3.18 3.23	0.317 0.320	8.00 8.08	0.300 0.305	7.62 7.75	0.300 0.305	7.62 7.75

*Type B seal inserts are used extensively in steel or stainless steel and steel components of hydraulic brake systems. Where standard inserts are specified into other materials, modification of part may be necessary to ensure proper installation.

*On Type B inserts, F dimension defines width of F end.

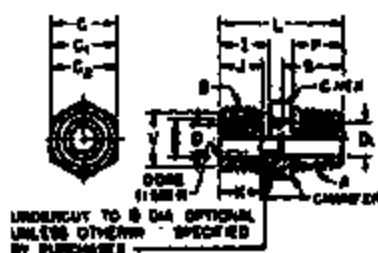


FIG. 12A (060102)



FIG. 12B (060103)

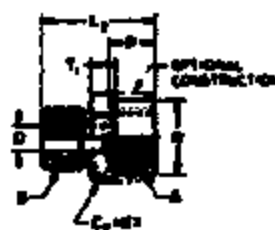


FIG. 12C (060103)

FIG. 12—CONNECTORS AND UNIONS

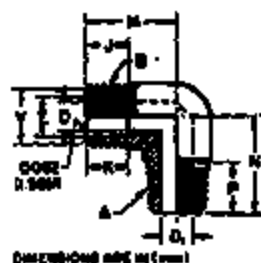


FIG. 13A (060202)

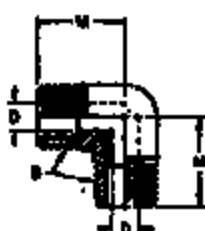


FIG. 13B (060201)



FIG. 13C (060203)

FIG. 13—ELBOWS



FIG. 14A (080401)

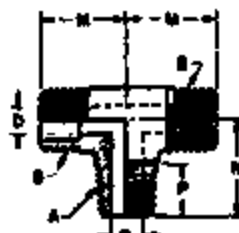


FIG. 14B (080425)

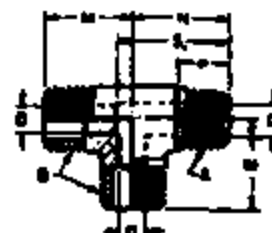


FIG. 14C (080430)

FIG. 14—TAPER

NOTE: UNFINISHED DETAILS WITH RESPECT TO DIMENSIONS, TOLERANCES, CONDITIONS, MATERIAL, WORKMANSHIP, ETC., MUST CONFORM TO GENERAL SPECIFICATIONS FOR MANUFACTURING THIS PRODUCT. THE DIMENSIONAL TOLERANCES ON THE FIRST FIGURE IN EACH GROUP SHALL APPLY TO ALL OTHER FIGURES IN THAT GROUP UNLESS OTHERWISE SPECIFIED. DIMENSIONS SHOWN IN PARENTHESES ARE ALTERNATE TO FIGURE NUMBERS REPRESENTING RESPECTIVE FITTING IDENTIFICATION IN ACCORDANCE WITH SAE J484.

TABLE 14—DIMENSIONS OF SHORTER, TAPER, AND TAPERED TUBES 1/8 TO 1/4

Nominal Tube OD, in	A Bore Type Thread NPTF, in	B, Nom. Thread Size, in Class 2A, Int.	C Nom., in	C ₁ Nom., in	C ₂ Nom., in	D ₁ to D ₂		D ₃ to D ₄		E to F		G to H		I to J	
						in	mm	in	mm	in	mm	in	mm	in	mm
1/8	1/8	5/16-24	7/16	3/16	9/16	0.094	2.39	0.219	5.56	0.134	3.40	0.200	5.08	0.25	6.35
3/16	1/8	3/8-24	7/16	3/8	9/16	0.125	3.17	0.219	5.56	0.195	4.95	0.213	5.41	0.25	6.35
1/4	1/8	7/16-24	7/16	7/16	9/16	0.188	4.77	0.219	5.56	0.200	5.08	0.200	5.08	0.25	6.35
5/16	1/8	1/2-24	1/2	1/2	9/16	0.250	6.35	0.219	5.56	0.200	5.08	0.200	5.08	0.25	6.35
3/8	1/4	1/2-24	9/16	—	—	0.250	6.35	0.219	5.56	0.200	5.08	0.200	5.08	0.25	6.35
7/16	1/4	5/8-24	5/8	5/8	11/16	0.312	7.92	0.244	6.20	0.207	5.26	0.200	5.08	0.25	6.35
1/2	3/8	11/16-20	11/16	11/16	13/16	0.406	10.31	0.260	6.60	0.214	5.44	0.200	5.08	0.25	6.35
5/8	1/2	1 1/16-16	1 1/16	1 1/16	1 1/8	0.625	15.87	0.260	6.60	0.214	5.44	0.200	5.08	0.25	6.35
3/4	1/2	1 1/8-16	1 1/8	1 1/8	1 1/4	0.750	19.05	0.260	6.60	0.214	5.44	0.200	5.08	0.25	6.35
1/8	1/8	5/16-24	7/16	3/16	9/16	0.094	2.39	0.219	5.56	0.134	3.40	0.200	5.08	0.25	6.35
3/16	1/8	3/8-24	7/16	3/8	9/16	0.125	3.17	0.219	5.56	0.195	4.95	0.213	5.41	0.25	6.35
1/4	1/8	7/16-24	7/16	7/16	9/16	0.188	4.77	0.219	5.56	0.200	5.08	0.200	5.08	0.25	6.35
5/16	1/8	1/2-24	1/2	1/2	9/16	0.250	6.35	0.219	5.56	0.200	5.08	0.200	5.08	0.25	6.35
3/8	1/4	1/2-24	9/16	—	—	0.250	6.35	0.219	5.56	0.200	5.08	0.200	5.08	0.25	6.35
7/16	1/4	5/8-24	5/8	5/8	11/16	0.312	7.92	0.244	6.20	0.207	5.26	0.200	5.08	0.25	6.35
1/2	3/8	11/16-20	11/16	11/16	13/16	0.406	10.31	0.260	6.60	0.214	5.44	0.200	5.08	0.25	6.35
5/8	1/2	1 1/16-16	1 1/16	1 1/16	1 1/8	0.625	15.87	0.260	6.60	0.214	5.44	0.200	5.08	0.25	6.35
3/4	1/2	1 1/8-16	1 1/8	1 1/8	1 1/4	0.750	19.05	0.260	6.60	0.214	5.44	0.200	5.08	0.25	6.35
1/8	1/8	5/16-24	7/16	3/16	9/16	0.094	2.39	0.219	5.56	0.134	3.40	0.200	5.08	0.25	6.35
3/16	1/8	3/8-24	7/16	3/8	9/16	0.125	3.17	0.219	5.56	0.195	4.95	0.213	5.41	0.25	6.35
1/4	1/8	7/16-24	7/16	7/16	9/16	0.188	4.77	0.219	5.56	0.200	5.08	0.200	5.08	0.25	6.35
5/16	1/8	1/2-24	1/2	1/2	9/16	0.250	6.35	0.219	5.56	0.200	5.08	0.200	5.08	0.25	6.35
3/8	1/4	1/2-24	9/16	—	—	0.250	6.35	0.219	5.56	0.200	5.08	0.200	5.08	0.25	6.35
7/16	1/4	5/8-24	5/8	5/8	11/16	0.312	7.92	0.244	6.20	0.207	5.26	0.200	5.08	0.25	6.35
1/2	3/8	11/16-20	11/16	11/16	13/16	0.406	10.31	0.260	6.60	0.214	5.44	0.200	5.08	0.25	6.35
5/8	1/2	1 1/16-16	1 1/16	1 1/16	1 1/8	0.625	15.87	0.260	6.60	0.214	5.44	0.200	5.08	0.25	6.35
3/4	1/2	1 1/8-16	1 1/8	1 1/8	1 1/4	0.750	19.05	0.260	6.60	0.214	5.44	0.200	5.08	0.25	6.35

When SAE Short Pipe Thread is indicated by purchaser, dimensions I, L, M, N, P, S, and T are reduced in accordance with reduction of pipe thread length. See SAE J484, Tables 3 and 4.

The full depths given require use of tapering taps to produce standard full thread length. For increased tap clearance, see Internal Taper Pipe Threads in General Specifications.

Where three tap reduction is used, the last thread shall be chamfered 1/2 to 1 inch long from O diameter.

The manufacturer's option, through passages or flange shown in Figures 12A and 12C, may be used with smaller diameter specified in the specification and may be constructed to larger diameter for depths defined by S or L, respectively.

Minimum depth flange, see subject to specification.

Flange dimensions shown shall apply to standard diameter or larger. Flange for smaller, the -0.02 to -0.3 and minimum shall apply only to standard diameter or larger. Flange shown in Figure 12C.

FIG. 15—TAPERED SLEEVES (000115)



TABLE 11—DIMENSIONS OF TAPERED SLEEVES (FIGURE 15)

Nose Taper DIN in	D DIN		E DIN		F DIN		G DIN	
	in		in		in		in	
	±0.000	±0.00	±0.000	±0.00	±0.000	±0.00	±0.000	±0.00
1/8	0.130	3.30	0.130	3.30	0.130	3.30	0.130	3.30
3/16	0.187	4.75	0.187	4.75	0.187	4.75	0.187	4.75
1/4	0.250	6.35	0.250	6.35	0.250	6.35	0.250	6.35
5/16	0.312	7.92	0.312	7.92	0.312	7.92	0.312	7.92
3/8	0.375	9.52	0.375	9.52	0.375	9.52	0.375	9.52
7/16	0.437	11.10	0.437	11.10	0.437	11.10	0.437	11.10
1/2	0.500	12.70	0.500	12.70	0.500	12.70	0.500	12.70
5/8	0.625	15.87	0.625	15.87	0.625	15.87	0.625	15.87
3/4	0.750	19.05	0.750	19.05	0.750	19.05	0.750	19.05

FIG. 16—SHORT NUTS (000116)

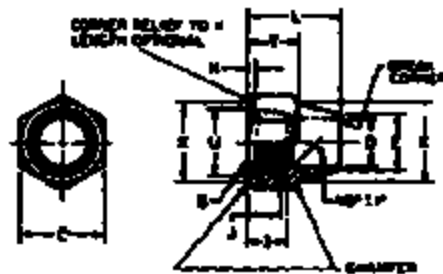
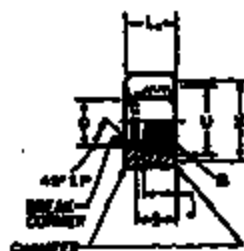


FIG. 17—LONG NUTS (000117)

TABLE 12—DIMENSIONS OF SHORT AND LONG NUTS (FIGURES 16 AND 17)

Nose Taper DIN in	D Straight Nose DIN in	E DIN in	D DIN		E DIN		F DIN		G DIN		H DIN		I DIN		J DIN		K DIN		L DIN		M DIN		N DIN	
			in		in		in		in		in		in		in		in		in		in		in	
			±0.000	±0.00	±0.000	±0.00	±0.000	±0.00	±0.000	±0.00	±0.000	±0.00	±0.000	±0.00	±0.000	±0.00	±0.000	±0.00	±0.000	±0.00	±0.000	±0.00	±0.000	±0.00
1/8	5/16-34	3/8	0.130	3.30	0.130	3.30	0.130	3.30	0.130	3.30	0.130	3.30	0.130	3.30	0.130	3.30	0.130	3.30	0.130	3.30	0.130	3.30	0.130	3.30
3/16	3/8-34	7/16	0.187	4.75	0.187	4.75	0.187	4.75	0.187	4.75	0.187	4.75	0.187	4.75	0.187	4.75	0.187	4.75	0.187	4.75	0.187	4.75	0.187	4.75
1/4	7/16-34	1/2	0.250	6.35	0.250	6.35	0.250	6.35	0.250	6.35	0.250	6.35	0.250	6.35	0.250	6.35	0.250	6.35	0.250	6.35	0.250	6.35	0.250	6.35
5/16	1/2-34	9/16	0.312	7.92	0.312	7.92	0.312	7.92	0.312	7.92	0.312	7.92	0.312	7.92	0.312	7.92	0.312	7.92	0.312	7.92	0.312	7.92	0.312	7.92
3/8	9/16-34	5/8	0.375	9.52	0.375	9.52	0.375	9.52	0.375	9.52	0.375	9.52	0.375	9.52	0.375	9.52	0.375	9.52	0.375	9.52	0.375	9.52	0.375	9.52
7/16	5/8-34	11/16	0.437	11.10	0.437	11.10	0.437	11.10	0.437	11.10	0.437	11.10	0.437	11.10	0.437	11.10	0.437	11.10	0.437	11.10	0.437	11.10	0.437	11.10
1/2	11/16-34	13/16	0.500	12.70	0.500	12.70	0.500	12.70	0.500	12.70	0.500	12.70	0.500	12.70	0.500	12.70	0.500	12.70	0.500	12.70	0.500	12.70	0.500	12.70
5/8	13/16-34	15/16	0.625	15.87	0.625	15.87	0.625	15.87	0.625	15.87	0.625	15.87	0.625	15.87	0.625	15.87	0.625	15.87	0.625	15.87	0.625	15.87	0.625	15.87
3/4	1-11	1-13	0.750	19.05	0.750	19.05	0.750	19.05	0.750	19.05	0.750	19.05	0.750	19.05	0.750	19.05	0.750	19.05	0.750	19.05	0.750	19.05	0.750	19.05

TABLE 13

Nominal Pipe Thread DIN in	Internal Thread								External Thread							
	Chamber Diameter				Length of Chamfer or Full Thread				Chamber Diameter				Length of Chamfer or Full Thread			
	Min		Max		Min		Max		Min		Max		Min		Max	
	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm
1/8	0.22	5.6	0.26	6.6	0.007	0.18	0.007	0.18	0.22	5.6	0.26	6.6	0.007	0.18	0.007	0.18
1/4	0.42	10.7	0.46	11.7	0.007	0.18	0.007	0.18	0.42	10.7	0.46	11.7	0.007	0.18	0.007	0.18
3/8	0.58	14.6	0.62	15.7	0.007	0.18	0.007	0.18	0.58	14.6	0.62	15.7	0.007	0.18	0.007	0.18
1/2	0.88	22.4	0.92	23.4	0.007	0.18	0.007	0.18	0.88	22.4	0.92	23.4	0.007	0.18	0.007	0.18
3/4	1.12	28.4	1.16	29.4	0.007	0.18	0.007	0.18	1.12	28.4	1.16	29.4	0.007	0.18	0.007	0.18

Tolerances conform with Appendix A, SAE J478.

APPENDIX A—GAGES AND GAGING FOR INVERTED FLARED TYPE FITTINGS

A1. General.—The information contained herein is intended to provide and promote the use of uniform gaging practices for determining conformance of inverted flared type tube fittings with the specifications given in the standard.

Gaging of Cone Seats

Depth of Face.—Proper location of the face of the cone seat relative to the face of the fitting shall be determined by use of the gage depicted in Figure A1. One-half of the top surface of body of the gage shall be machined and/or ground 0.015 in (0.38 mm) below the balance of surface to provide a low limit stop. The gage pin shall have a minimum diameter equal to "E min" (see Table 4) and shall be of a length equivalent to the sum of the height of the high limit side of gage body plus "E min" (see Table 4). The opposite faces of gage body and each of gage pin shall be flat, smooth, parallel, and square with the axis of pin. The fit between gage pin and gage body shall be such that the pin alignment is maintained yet free to move, of its own weight, within the gage body. All gage components should be made from steel suitably hardened to ensure adequate service life.

When this gage is placed on the face of fitting, in line with the axis of seat and with gage pin contacting face of seat, the top of gage pin

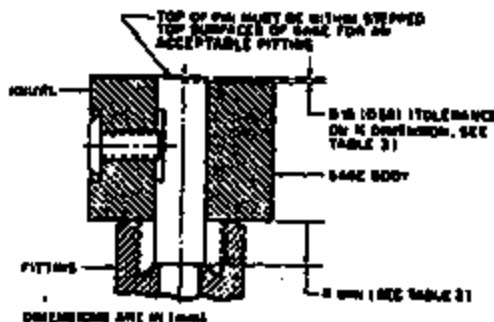


FIG. A1—FLUSH PIN GAGE FOR CHECKING LOCATION OF FACE OF CONE SEAT

must not protrude above the high limit nor be below the low limit top surfaces of the gage body for fitting to be acceptable.

Gaging of Internal Threads

Size and Form.—Conformance of internal threads with the dimensions specified shall be determined in accordance with standard thread gaging procedures.

Full Form Thread Depth.—Suitability of the relationship between the full form thread to the face of the cone seat shall be determined by use of the gage depicted in Figure A2. This gage shall have external threads, conforming in all respects with the corresponding GO thread plug gage for the respective thread size, of a minimum length equal to "K min" (see Table 4) plus one pitch (thread) and shall have the partial thread at starting and removed. Use of a thread relief undercuts beyond a length equal to "K min" shall be permissible. The gage pin hole at starting end shall be suitably counterbored to clear the fitting cone seat to a depth equivalent to $1\frac{1}{2}$ pitches (threads). The length of the gage pin shall be equivalent to the overall length of the body of gage plus the difference between "J min" (see Table 4) and $\frac{1}{2}$ pitch (thread). All other features of gage body, gage pin, fit and material shall be as specified for the gage in Figure A1.

When this gage is assembled by hand into the fitting as far as the thread will permit, with pin contacting face of cone seat, the top of the gage pin must be flush with or protrude above the top surface of the gage body for fitting to be acceptable.

Concentricity Gage and Gaging

Cone Seat Concentricity.—Conformance with specified limitations on concentricity of cone seats with respect to thread pitch cylinder shall be checked by the use of functional gages of the type described herein and depicted in Figure A3, or equivalent means.

The gage consists of a body or frame providing a means for mounting a dial indicator gage in such a manner that it can be actuated through a rotating pin on the opposite end of which is a machined stylus designed to ride on the conical surface of the seat. The gage is cen-

tered on the threads of the fitting by means of an interchangeable male threaded gage insert. The threads on the insert shall conform in all respects with the corresponding GO thread plug gage for the respective thread size and the length of full form thread shall be equivalent to "K min" (see Table 3) plus one pitch (thread). The remaining end of gage insert shall have a pilot of length equal to one pitch (thread) and diameter which will clear the minor diameter of the seat threads. The first thread beyond the pilot shall be chamfered or the partial portion shall be removed. Use of a thread relief undercut beyond a length equivalent to "K min" shall be permissible. The fit between the stylus extension pin and the hole through gage body and threaded gage insert shall be such that pin will move freely yet be retained in alignment. Fixing mechanism may be consisted with regard to details of existing gages.

The fitting to be inspected shall be gaged in accordance with the following procedure:

1. The threaded end of gage shall be assembled by hand into the seat on the fitting as far as the thread will permit.
2. The indicator gage shall be moved and the stylus then rotated slowly through a complete 360 degree revolution by twisting the knurled collar through the finger member to gage body.

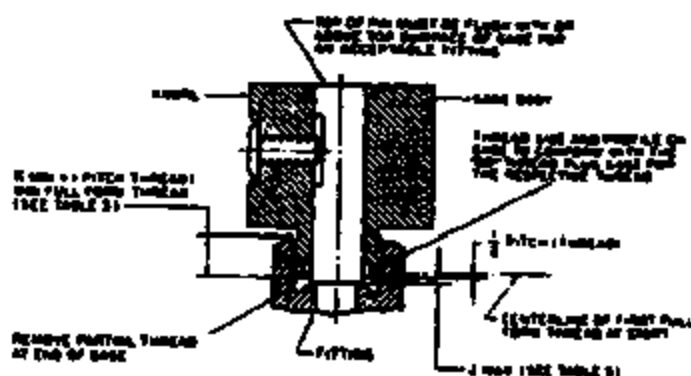


FIG. A2—FLUSH PIN GAGE FOR CHECKING RELATION OF END OF FULL THREAD WITH FACE OF CONE SEAT

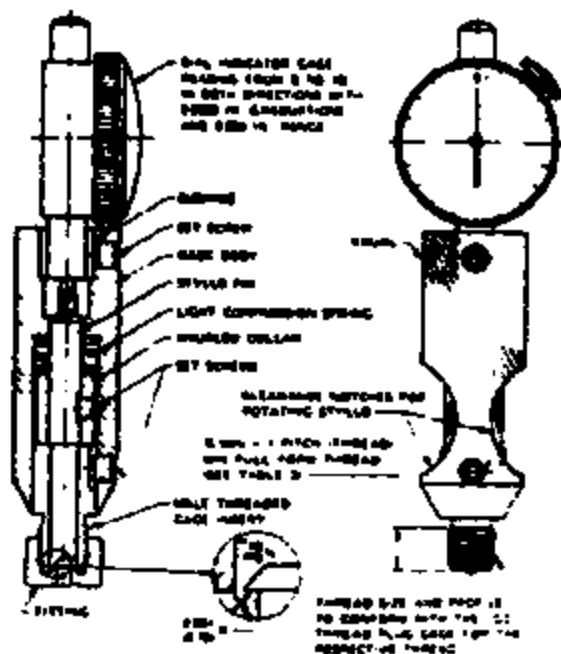


FIG. A3—TYPICAL CONE SEAT CONCENTRICITY GAGE

5. The total runout indicated throughout the rotation of styles shall be read and recorded. It shall not exceed 0.0086 (0.142 mm) for the fitting to be acceptable. (The measured deviation is in a plane perpendicular to the plane of the cone seat. The concentricity variation, therefore, may be determined from Table A1, or by multiplying the dial indicator reading by the tangent of 42 degrees, or 0.90066.)

TABLE A1

Dial Reading		Concentricity		Dial Reading		Concentricity	
in	mm	in	mm	in	mm	in	mm
	5 PL		4 PL		5 PL		4 PL
0.0005	0.013	0.0005	0.013	0.0005	0.013	0.0005	0.013
0.0010	0.025	0.0010	0.025	0.0010	0.025	0.0010	0.025
0.0015	0.038	0.0015	0.038	0.0015	0.038	0.0015	0.038
0.0020	0.051	0.0020	0.051	0.0020	0.051	0.0020	0.051
0.0025	0.064	0.0025	0.064	0.0025	0.064	0.0025	0.064
0.0030	0.076	0.0030	0.076	0.0030	0.076	0.0030	0.076
0.0035	0.089	0.0035	0.089	0.0035	0.089	0.0035	0.089
0.0040	0.102	0.0040	0.102	0.0040	0.102	0.0040	0.102

R) SPHERICAL AND FLANGED SLEEVE (COMPRESSION) TUBE FITTINGS—SAE J246 JUN90

SAE Standard

Report of the Tube, Pipe, Hose, and Lubrication Fittings Committee, approved May 1971. Last revised July 1977, subsequent change March 1981. Completely revised by the Fluid Conductors and Connectors Technical Committee, June 1990.

1. Scope—This SAE Standard covers complete general and dimensional specifications for tube fittings of the spherical and flanged sleeve compression types for use in the piping of air brake systems on automotive vehicles. The spherical sleeve compression type Figures 1a To 5 and Tables 5 to 7 is intended for use with standard copper alloy tubing per SAE J1149, Type 1. The flanged sleeve compression type Figures 6A to 11 and Tables 8 to 10 is intended for use with nylon tubing per SAE J844. It is not intended to restrict or preclude other designs of a tube fitting for use with SAE J844, air brake tubing. Performance requirements for SAE J844 are covered in J1151.

Caution: To insure satisfactory performance, tapered sleeve compression type components (SAE J619) should not be intermixed with the spherical or flanged sleeve components, nor should the spherical sleeve compression type components be intermixed with the flanged sleeve components when assembling connections in areas where the three types are available.

2. References

- 2.1 Applicable Documents
 - SAE J246 Spherical and Flanged Sleeve (Compression) Tube Fittings
 - SAE J476 Dryseal Pipe Threads
 - SAE J512 Automotive Tube Fittings
 - SAE J844 Nonmetallic Air Brake System Tubing
 - SAE J846 Coding Systems for Identification of Fluid Conductors and Connectors
 - SAE J1151 Performance Requirements for SAE J844 Nonmetallic Tubing and Fitting Assemblies Used in Automotive Air Brake Systems
 - SAE J1149 Metallic Air Brake System Tubing and Pipe
 - ANSI B1.1
 - ASTM B 117

3. General Specifications—The following general specifications supplement the dimensional data contained in Tables 5 to 10 with respect to all unspecified details.

3.1 Identification—At manufacturer's option, or where so specified by the purchaser, the fittings, except sleeves, may be permanently and legibly marked with air brake. The marking shall be permanently and legibly marked according to the current U.S. Department of Transportation FMVSS 106 Regulation (NHTSA). The location of such markings shall be optional with manufacturer.

3.2 Size Designations—Fitting sizes are designated by the corresponding nominal outside diameter of the tubing for the various sizes of tube ends and by the corresponding standard nominal pipe size for pipe thread ends.

3.3 Dimensions and Tolerances—Except for nominal size and thread specifications, dimensions and tolerances are given in both U.S. customary and SI units as designated. Tabulated dimensions shall apply to the finished parts. The maximum and minimum cross flat dimensions shall be within the commercial tolerance of bar or extruded stock from which the fittings are produced. The minimum across corner dimensions of hexagons shall be 1.092 times the nominal width across flats, but shall not result in a side flat width less than 0.45 times the nominal width across flats.

Unless otherwise specified, tolerances on hole diameters designated drill in the dimensional tables shall be as tabulated in Table F.

TABLE 1

Ball Size Range		Tolerances			
in	mm	Pitch		Stress	
		in	mm	in	mm
0.0125 thru 0.1875	0.3175 thru 4.7625	0.0025	0.0635	0.0025	0.0635
0.1875 thru 0.2500	4.7625 thru 6.3500	0.0030	0.0762	0.0030	0.0762
0.2500 thru 0.3750	6.3500 thru 9.5250	0.0035	0.0889	0.0035	0.0889
0.3750 thru 0.5000	9.5250 thru 12.7000	0.0040	0.1016	0.0040	0.1016

Tolerances on all dimensions not otherwise specified shall be ± 0.004 in (0.1016 mm). Tube end diameters shall be concentric with straight thread pitch diameters within 0.010 in (0.254 mm) ball indicator reading (FIR). Large end diameters shall be concentric with tube end diameters within 0.005 in (0.127 mm) ball indicator reading (FIR). The surface of tube end at base of nut shall be flat and perpendicular to the axis of thread. Angular tolerance on axis of ends of elbows and tees shall be ± 1.50 degrees for sizes up to and including 3/8 in, and ± 1.50 degrees for sizes larger than 3/8 in.

Where so illustrated, hexagon corners shall be chamfered 30 degrees ± 5 to a diameter equal to the nominal width across flats, with a tolerance of -0.016 in (-0.41 mm) or, where design permits, corners may be chamfered to the diameter of the chamfer surface, provided the length of chamfer does not exceed that produced by the 30 degree chamfer previously described.

3.4 Passages—Where passages in straight fittings are machined from opposite ends, the offset at the meeting point shall not exceed 0.010 in (0.254 mm). The cross-sectional area at the junction of passages in angle fittings shall not be less than that of the smallest passage. At manufacturer's option, all passages in a particular fitting may conform with the smallest diameter specified for that fitting. Where the passage is specified as tap drill diameter or less, the minimum shall be no less than the minimum diameter of the smallest passage in the fitting.

3.5 Wall Thickness—Unless otherwise designated, the wall thickness at any point on fittings shall not be less than the thickness established by the specified dimensions, tolerances, and eccentricities for outer and inner surfaces.

3.6 Contours—Details of contour shall be optional with manufacturer, provided the tabulated dimensions are maintained and serviceability of the fittings is not impaired. Wrench flats on elbows and tees shall be optional. Where extruded and forged shapes are reduced to corner material, the wall thickness, unless otherwise specified, shall not be less than the respective minimum values tabulated in Table 2.

3.7 Straight Threads—Unified standard Class 2A external and Class 2B internal threads shall apply to plain finish (unplated) fittings of all types. For internally threaded parts with additional finish, the Class 2B diameters shall apply after plating.

The pitch diameter tolerance shall be the same as the corresponding diameter-pitch combination and class of the Unified 18 and 20 thread series or for special diameter-pitch combinations shall be based on diameter, pitch, and a length of engagement of 9 times the pitch per ANSI B1.1.

SURFACE DISCONTINUITIES AND FINISH IRREGULARITIES ON BOLTS AND SCREWS GM8102M

*See para 3.10 for
Tolerance
Spec*

1 SCOPE. This standard defines, illustrates and specifies allowable limits for the various types of surface discontinuities that may occur during the manufacture and processing of bolts, screws and studs, including heat treated machine screws, tapping screws, and screw and washer assemblies (the washer components of sets are excluded), in sizes 5 mm to 24 mm (No. 12 to 1 inch), inclusive, with lengths to 100 mm, inclusive, and with specified minimum tensile strength of 830 MPa (120,000 psi) and greater, which are primarily intended for use in automotive assemblies.

- 1.1 This standard also specifies the allowable size of lumps in surface finishes which may occur during the finish application processes on bolts and screws.

1.2 This standard does not include inspection sampling requirements. It is intended that the purchaser shall specify, in the original inquiry and purchase order, the inspection sampling requirements which the producer must satisfy to demonstrate the acceptability of bolts and screws with respect to surface discontinuities.

this standard, surface discontinuities on bolts and screws are classified into six "types," and these are defined as follows:

NOTE: The illustrations presented herein have been selected to typically exemplify the different types of surface discontinuities and are intended to apply correspondingly to other styles of bolts and screws having similar features or configurations.

2.1 CRACK. A crack is a sharp (crystalline) fracture passing through or across the grain boundaries, without inclusion of foreign elements. Cracks are normally caused by over-stressing the metal during forging or other forming operations, or during heat treatment. Where parts are subjected to significant reheating, cracks are usually disclosed by scale.

2.1.1 Quench Cracks. May occur during heat treatment due to excessively high thermal and transformation stresses. Quench cracks usually assume an irregular and erratic course on the surface of the bolt or screw. Typical quench cracks are shown in Figure 1.

2.1.2 Forging Cracks. May occur during the cut-off or forging (Continued)

2 TYPES OF SURFACE DISCONTINUITIES. For the purpose of

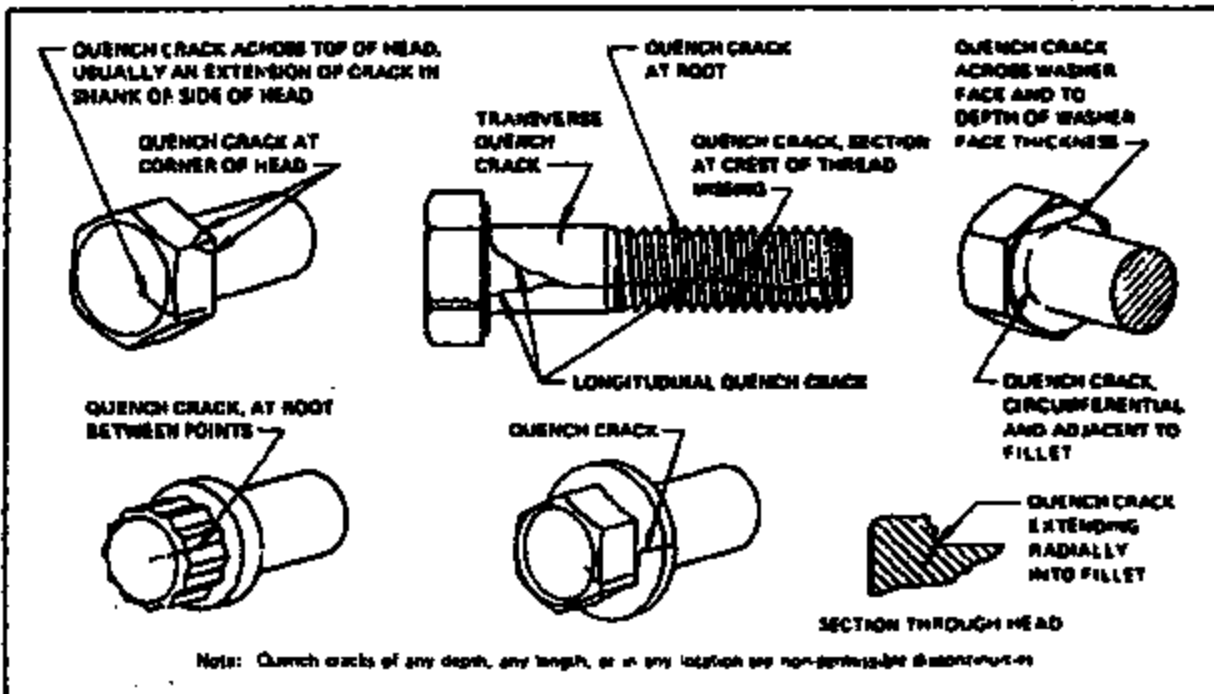


FIGURE 1 - TYPICAL QUENCH CRACKS

T. Denotes change from product data

CONTROL DIVISION	4-68	C	Revised Title Added Per 1781	AMST/MP
	11-81	B	Company revision	AMST/MP
	7-88	-	1781	AMST/MP
DATE		BY	REVISION RECORD	AUTHOR TV

SURFACE DISCONTINUITIES AND FINISH IRREGULARITIES ON BOLTS AND SCREWS GM0102M

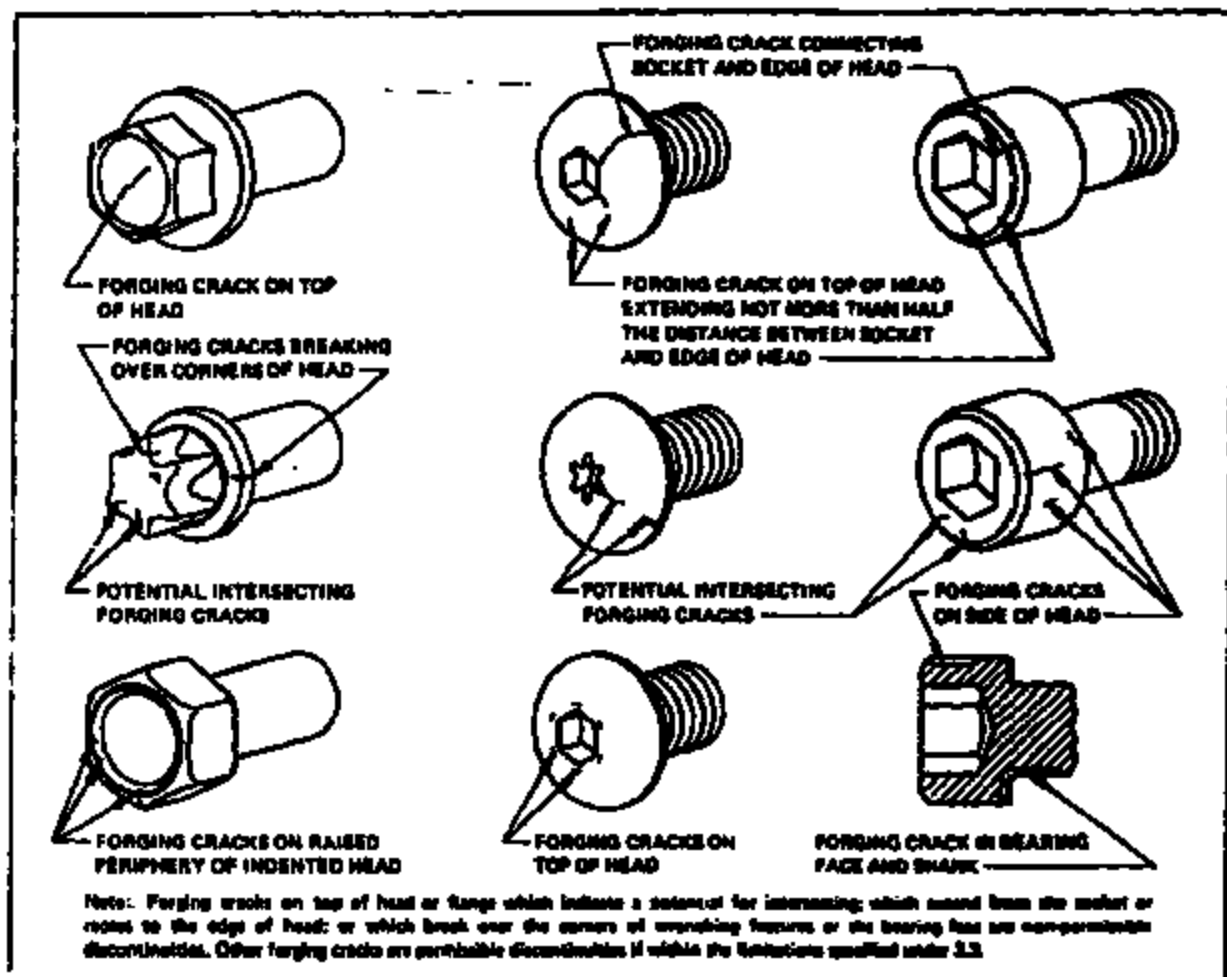


FIGURE 2A - TYPICAL FORGING CRACKS IN HEADS OF BOLTS AND SCREWS

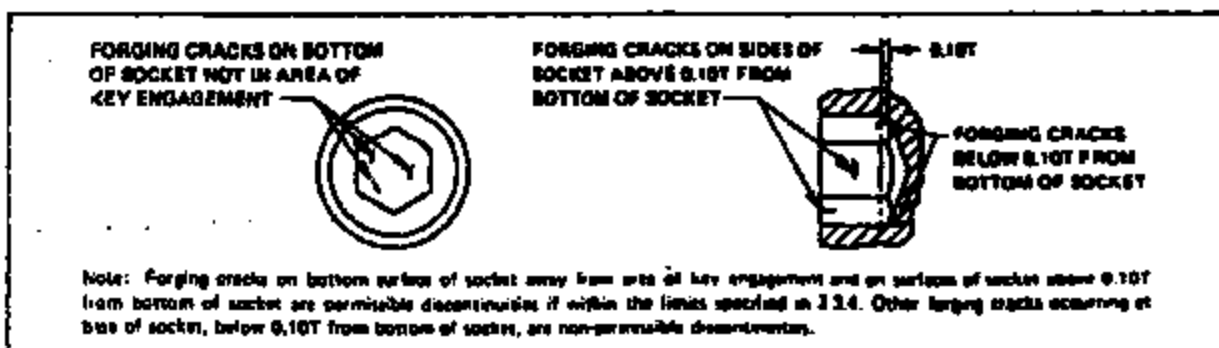


FIGURE 2B - TYPICAL FORGING CRACKS IN HEXAGON SOCKETS

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SURFACE DISCONTINUITIES AND FINISH IRREGULARITIES ON BOLTS AND SCREWS GM8102M

(Continued)

operations and are located on the top of the head of screws and bolts. Typical forging cracks are shown in Figures 2A and 2B.

2.2 SEAM. A seam is a narrow continuous discontinuity in the metal. Seams are generally inherent in the raw material from which the bolt or screw is made. Seams in bolts and screws are usually straight or smooth-curved line discontinuities running generally parallel to the product axis. A typical seam is shown in Figure 3.

2.3 BURST. A burst is an open break in the metal. Bursts may occur at the flat of the head of bolts or screws or at the periphery of flanged or circular head products. Typical bursts are shown in Figure 4.

2.4 SHEAR BURST. A shear burst is an open break in the metal located at the periphery of flanged bolts and screws and approximately at a 45 degree angle to the product axis. Shear bursts

occur most frequently with flanged products and are due to overstressing the metal during forging. Typical discontinuities of this type are shown in Figure 4.

2.5 VOID. A void is a shallow pocket or hollow on the surface of the bolt or screw due to non-filling of metal during forging or upsetting. Typical voids are shown in Figure 5.

2.6 LAP. A lap is a fold-over of metal in the threads of screws and bolts. If laps occur, they generally show a pattern of discontinuity between the product, i.e., laps will be identically located and with the same direction of traverse between all products. Typical laps in external screw threads are shown in Figure 6A.

2.7 FOLD. A fold is a doubling over of metal which may occur during the forging operation. Folds may occur in or over the

(Continued)

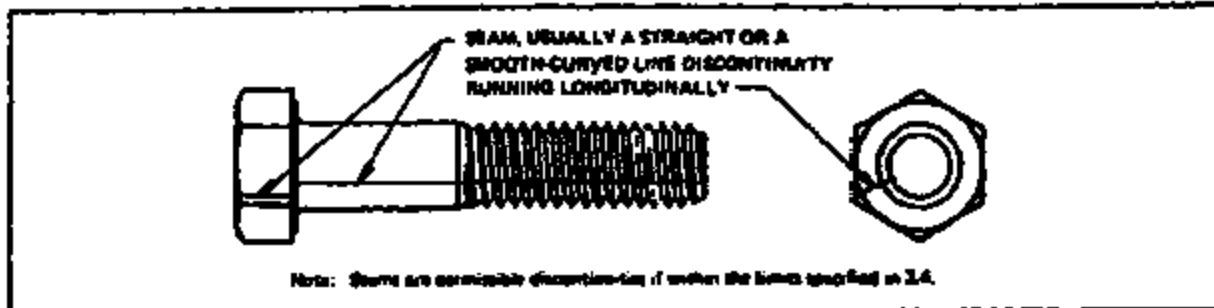


FIGURE 3 - TYPICAL SEAM

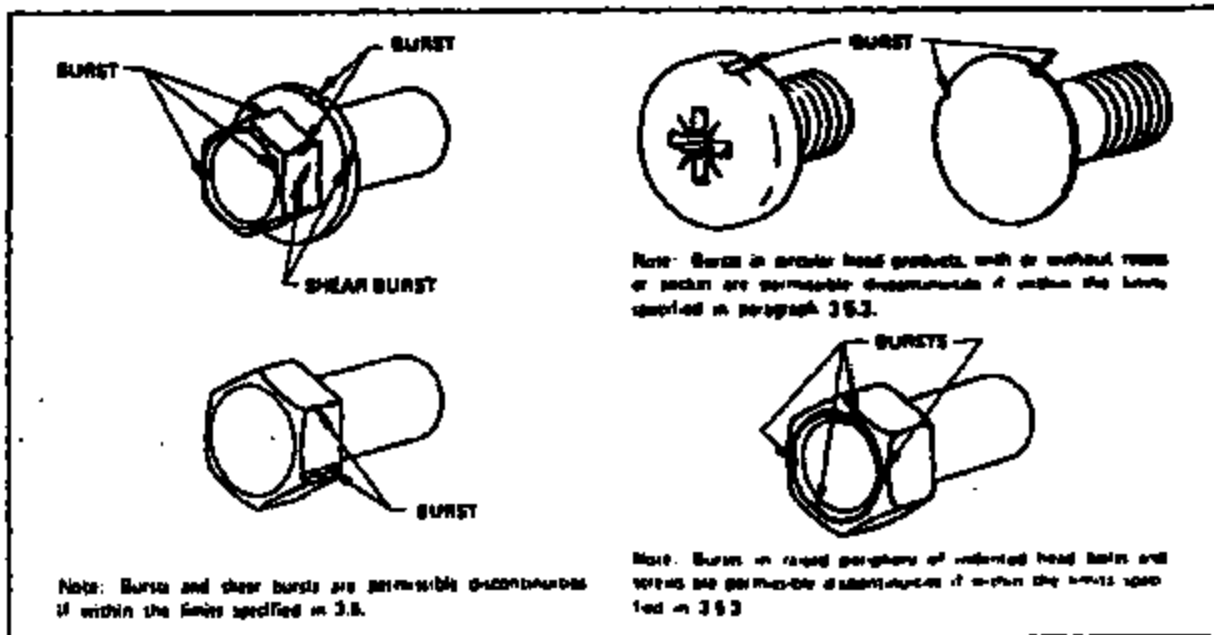


FIGURE 4 - TYPICAL BURSTS AND SHEAR BURSTS

SURFACE DISCONTINUITIES AND FINISH IRREGULARITIES ON BOLTS AND SCREWS GM9102M

(Continued)

intersection of diameter or configuration changes. Typical bolts are shown in Figure 7.

2.8 TOOL MARKS. Tool marks are longitudinal or circumferential grooves of shallow depth produced by the movement of manufacturing tools over the surface of the bolt or screw. Typical tool marks are shown in Figure 8.

2.9 NICK OR GULL'OE. A nick or gull'oe is an indentation on the surface of a bolt or screw, produced by forced abrasion or the impact of product coming into contact with other product or processing equipment during the manufacturing and packaging operations.

3 LIMITS FOR SURFACE DISCONTINUITIES.

3.1 LETTER DEFINITIONS. Throughout the following requirements, D designates the nominal size (basic major diameter of thread) of bolts, screws and studs, except for bolts and screws with shoulders, in which case D designates the largest shoulder diameter. F designates the nominal flange diameter or the head diameter of products having circular heads. T designates the actual (measured) key engagement depth in socket screws. For metric-series products, use millimeter; for inch-series products, use inch.

NOTE: The illustrations referenced for each of the following requirements are chosen to exemplify the typical respective discontinuity and are intended to apply correspondingly to other styles of bolts and screws having similar features or configurations.

3.2 QUENCH CRACKS. Quench cracks of any depth, any length, or in any location are not permitted. (See 2.1.1 and Figure 1.)

3.3 FORGING CRACKS.

3.3.1 Forging cracks located on the top of head or flange of bolts or screws with a traverse indicating a potential to intersect, cracks connecting a socket or recess drive provision with the edge of the head, and cracks which break over corners of wrenching features are not permissible discontinuities. (See 2.1.2 and Figure 2A.)

3.3.2 Forging cracks on the top of heads embodying hexagon or double hexagon (12-Point) driving features or without any driving provision shall not exceed a length equal to 1.0D or a depth equivalent to 0.000D plus 0.20 mm. Forging cracks which extend not more than one-half the distance between the edges of the head and a socket or recess drive provision and other cracks occurring on the top surface of head or flange, the bearing face or the fillet area (only one crack in a longitudinal direction at junction of head and shank is acceptable on socket head cap screws) shall not exceed a depth equivalent to 0.000D or 0.13 mm, whichever is greater. For cracks on the periphery of circular heads, the maximum depth may be equal to 0.060D but in no case shall exceed 1.6 mm. (See 2.1.2 and Figure 2A.)

3.3.3 Forging cracks in the raised periphery of indented head bolts

and screws shall not exceed a width equal to 0.000D plus 0.25 mm or have a depth greater than the height of the raised periphery. (See 2.1.2 and Figure 2A.)

3.3.4 Forging cracks occurring in socket wells within 0.50T from the bottom of socket or in the base, or adjacent to the wells, are not permissible discontinuities. Cracks located close-base in socket wells or in the bottom surface away from area of driver engagement are permissible provided they do not exceed a length equivalent to 0.25T and a depth of 0.000D or 0.13 mm, whichever is greater. (See 2.1.2 and Figure 2B.)

3.4 SEAMS. Seams in the shanks of bolts and screws shall not exceed (a) an open width at the surface of 0.13 mm for sizes 5 to 12 mm (No. 12 to 7/16 in.) inclusive and 0.25 mm for sizes 14 mm (1/2 in.) and larger and (b) a depth of 0.000D + 0.13 mm for sizes 5 to 14 mm (No. 12 to 5/8 in.) inclusive and 0.000D for sizes over 16 mm (5/8 in.). (See 2.2 and Figure 3.)

3.5 BURSTS AND SHEAR BURSTS.

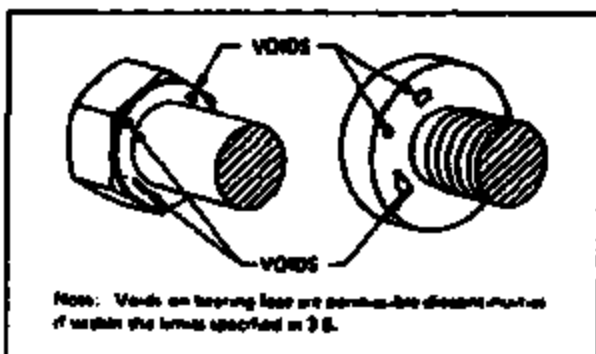
3.5.1 No burst in the flange of hex bolts and screws shall extend into the crown circle on the top of head surface (circular curves) or into the underhead bearing surface. In addition, bursts occurring at the intersection of two wrenching flats shall not reduce the width across corners below the specified minimum. (See 2.3, 2.4 and Figure 4.)

3.5.2 Flanges of bolts and screws and peripheries of circular head products may have two or more bursts or shear bursts providing they only are less than 0.13 mm + 0.000F or an open depth greater than 0.06 mm + 0.002F. In addition, this one burst shall not have a width exceeding 0.25 mm + 0.002F or an open depth of 0.13 mm + 0.004F.

3.5.3 Bursts in the raised periphery of indented head bolts and screws shall not exceed a width of 0.25 mm + 0.000D, or have a depth greater than the height of the raised periphery. (See 2.3 and Figure 4.)

3.6 VOIDS ON BEARING SURFACE. Voids on the bearing surface of bolts and screws shall not exceed a depth of 0.25 mm and the

(Continued)



**FIGURE 5
TYPICAL VOIDS ON BEARING SURFACE**

SURFACE DISCONTINUITIES AND FINISH IRREGULARITIES ON BOLTS AND SCREWS GM8102M

(Continued)

combined area of all voids shall not exceed 5 percent of the specified minimum area of the bearing surface. (See 2.5 and Figure 5.)

3.7 LAPS IN SCREW THREADS. Laps of any depth and any length which originate below (or originate above and extend below) $1/5$ of the thread height, measured from the minor diameter, are not permitted (See 2.6 and Figure 6A.) This requirement is not applicable to tapping screws having spaced threads. When approved by the purchaser, marks on flanks of threads caused by the seating

serrations on thread rolling dies (see Figure 6B) shall be excluded from these requirements.

3.8 FOLDS.

3.8.1 Except for "cloverleaf" folds occurring at the intersection of non-circular shoulders with head bearing face, folds located in interior corners at or below the bearing surface, e.g., at the fillet at the junction of head and shank, are not permitted. (See 2.7 and Figure 7.)

(Continued)

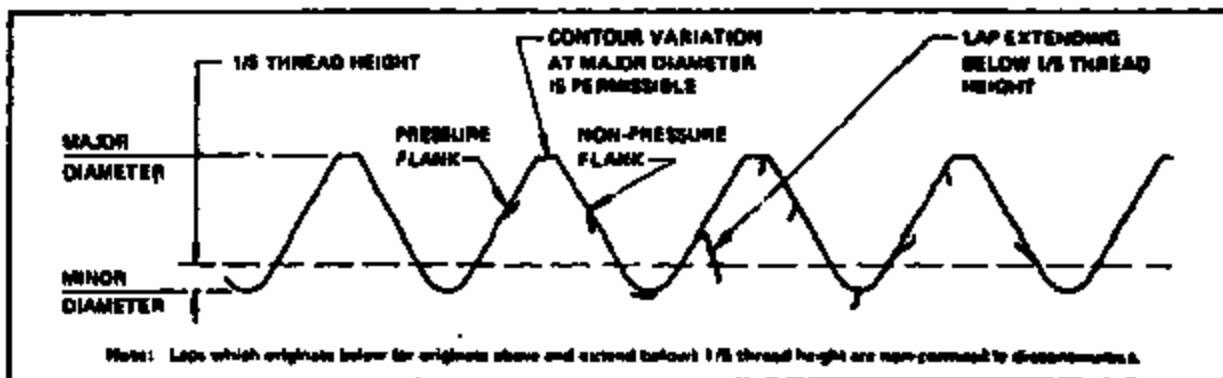


FIGURE 6A - TYPICAL LAPS

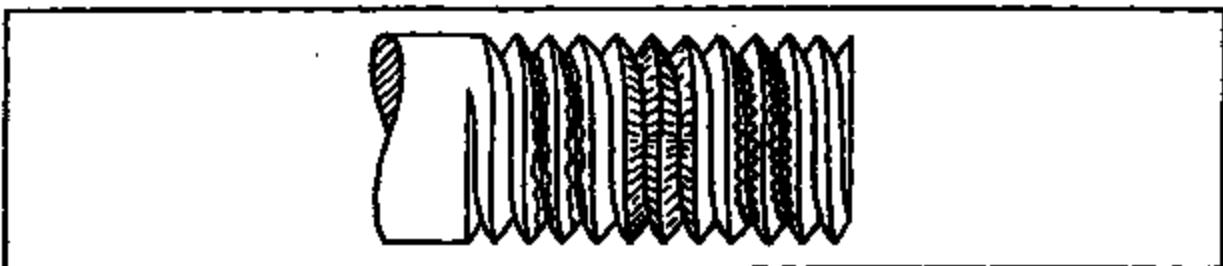


FIGURE 6B - STARTING SERRATION MARKS

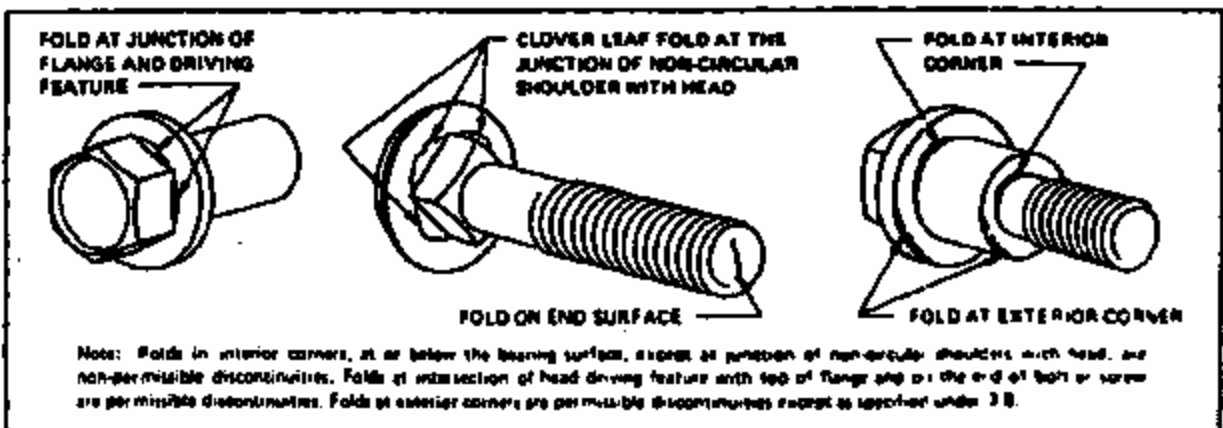


FIGURE 7 - TYPICAL FOLDS

SURFACE DISCONTINUITIES AND FINISH IRREGULARITIES ON BOLTS AND SCREWS

GM6102M

(Continued)

3.8.2 Folds which are located at the exterior intersection of the flange periphery and bearing surface of flanged bolts and screws, and project below the bearing surface are not permitted. (See 3.7 and Figure 7.)

3.8.3 Folds located at other exterior corners, interior folds at intersection of head driving feature with top surface of flange and folds located on the end surface of bolts and screws are permissible. (See 3.7 and Figure 7.)

3.9 TOOL MARKS. Tool marks on the bearing surface shall not exceed surface roughness measurement of 2.8µm. (See 3.8 and Figure 8.)

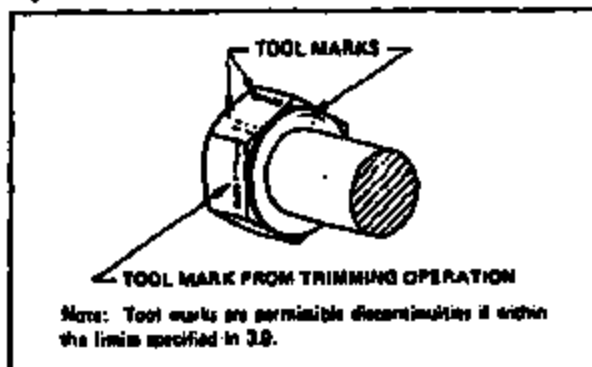


FIGURE 8 - TYPICAL TOOL MARKS

3.10 NICKS AND GOUGES. Nicks and gouges located in the threaded length shall not be of size and number which will interfere with assembly of the proper GO thread gage on the thread with the application of a maximum torque equivalent to 0.060 N·m (12.00 lb-in.). The manufacturer shall exercise due care during the manufacture and handling of bolts and screws to minimize the number and magnitude of nicks and gouges.

3.4 SURFACE FINISH IRREGULARITIES (Lumps in Finishes). All finishes shall be smooth and uniform and shall not interfere with assembly of the proper GO thread gage. Small finish lumps on the threaded surface may be acceptable only when the fastener passes the torque test outlined in Paragraph 3.10.

5 INSPECTION PROCEDURE. Unless otherwise specified by purchaser, the following irregularities shall be determined visually:

Quench Cracks	Shear Bars
Folds	Voids on Bearing Surfaces
Forging Cracks	Tool Marks
Seams	Nicks and Gouges
Burrs	Lumps in Surface Finishes

5.1 Unless otherwise specified by purchaser, tests and taps in threads shall be determined by deep and such or magnetic inspection techniques, or by other methods which have an equivalent capability to detect discontinuities of the size specified in 3.4 and 3.7. In the case of taps, the flow of magnetization current should be directed two ways so as to detect any discontinuities located transverse to the bolt or screw axis. In the case of acid etch, etch until flow lines are clearly apparent.

5.1.1 Bolts or screws showing indications which could be interpreted as seams shall be set aside. From this group, a secondary sample shall be picked at random and sectioned through the shank perpendicular to the axis, and etched for microscopic examination. The section shall be through the unthreaded body adjacent to the thread nearest. For bolts and screws which are threaded to the head, the section should be taken where the seam indication intersects the root of the thread at a distance of approximately one ID from the underside of the head. (A recommended procedure is outlined in ASTM E3, Methods of Preparing Metallographic Specimens.)

5.1.2 Bolts or screws showing indications which could be interpreted as laps in threads shall be set aside. From this group, a secondary sample shall be picked at random, surface-etched, and examined visually to determine that the pattern of laps is reasonably consistent between product. (NOTE: During this inspection, attention should also be given to examining the product for indications showing transverse quench cracks or folds in interior corners as these discontinuities are sometimes not readily seen in visual examination.) One of the specimens shall be sectioned longitudinally on the center line of the bolt or screw and on a plane passing through the point at which any lap extends closest to the minor diameter of the thread and the section etched for microscopic examination.

TI-NHTSA 002249



REQ. AREA		SUBJECT		PROGRAM		MODEL YEAR		CUSTOMER(S)		ECN NO. 25136																																														
VALVES		FW 10 PRESSURE SWITCH		QUAL. PROG.		91		FORD		PAGE 1 OF 1																																														
STATE OF CHARGE: REVISE THE T-11 PRESSURE SWITCH - NEW AUTOMATED VERSION IS AVAILABLE. IF THIS IS A CHANGE TO CUSTOMER DRAWING.																																																								
ADDITIONAL CUSTOMER REQUEST: [] PLANT REQUEST: [] VENDOR/PURCHASING REQUEST: [] T-11 NOW HAS THEIR AUTOMATED ASSY DOWING. NEED TO UPDATE PRINTS SO T-11 WILL REFLECT PRODUCTION LEVEL SWITCH. IN TEST WILL BE PERFORMED ON ENTIRE VALVE FOR T-11 TO FORD.																																																								
TEST INITIATED: YES [] NO [] CONCURRENT [] TEST DURATION: DAYS: 30 INITIATED BY: J. COSSINS 8-2 DATE: 9-5-91																																																								
<table border="1"> <thead> <tr> <th colspan="2">PRODUCT ENGINEERING</th> <th>DATE</th> <th colspan="2"></th> <th>DATE</th> <th colspan="2"></th> <th>DATE</th> </tr> </thead> <tbody> <tr> <td>ENGINEER</td> <td>J. H. COSSINS</td> <td>8-2-91</td> <td>D.A.</td> <td>T. PRYOR/LV</td> <td>8-20-91</td> <td>ESTIMATING</td> <td>K. R. HAWKINS</td> <td>8-20-91</td> </tr> <tr> <td>DESIGN</td> <td>NR</td> <td></td> <td>SALES</td> <td>D. CLINE/CB</td> <td>8-8-91</td> <td>PURCHASING</td> <td>R. IVES</td> <td>8-13-91</td> </tr> <tr> <td>FACTOR</td> <td>G. A. MILLI</td> <td>8-1-91</td> <td>COST AUTHORIZATION</td> <td>YES [] NO []</td> <td></td> <td>MANUFACTURING</td> <td>K. REILAK</td> <td>8-20-91</td> </tr> <tr> <td>ENGINEER</td> <td>C. DOWLING</td> <td>8-2-91</td> <td>COST RECOVERABLE</td> <td>YES [] NO []</td> <td></td> <td>ENGINEERING SERV</td> <td>CAV</td> <td></td> </tr> </tbody> </table>												PRODUCT ENGINEERING		DATE			DATE			DATE	ENGINEER	J. H. COSSINS	8-2-91	D.A.	T. PRYOR/LV	8-20-91	ESTIMATING	K. R. HAWKINS	8-20-91	DESIGN	NR		SALES	D. CLINE/CB	8-8-91	PURCHASING	R. IVES	8-13-91	FACTOR	G. A. MILLI	8-1-91	COST AUTHORIZATION	YES [] NO []		MANUFACTURING	K. REILAK	8-20-91	ENGINEER	C. DOWLING	8-2-91	COST RECOVERABLE	YES [] NO []		ENGINEERING SERV	CAV	
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ENGINEER	C. DOWLING	8-2-91	COST RECOVERABLE	YES [] NO []		ENGINEERING SERV	CAV																																																	
IF ENGINEERING MANUAL SECTION 2.811 ELICIT DESIGN DATA MARK, REVISION? YES [] NO [] SERVICE MANUAL REVIEWED? NO [] SERVICE MANUAL REVISED? NO [] T-11 A REVIEWED? YES [] T-11 A REVISED? NO []																																																								
DATE	REPLACE	RELEASE	THANK	DOC LEVEL	PART NAME / REVISION				CO-OR ORG	PURCH PART #	STOCK DISPOSITION																																													
8-1-91			D-12500701	A	ASSY - PRESSURE SWITCH - REVISE TO C-1 PRINT 77PSL2-1 WAS TO 57PSL2-1 MAKE THE ONLY VISIBLE CHANGE IS THE IMPRINT FROM THE SWITCH SO SPECIFIC CHANGES ARE: 1) CHANGE TO "57 IS MAX" WAS "62 IS MAX" 2) CHANGE TO "VALVE 90976-AA" WAS "VALVE 90976-BA" 3) CHANGE T-11 P/N TO "77PSL2-1" WAS "57PSL2-1" 4) REMOVE "FOR FINAL ASSY SEE DWG. 1250501" ASSY 'S' - FW 10 INIAL PROP REFLECT ABOVE CHANGES ON THOSE INGRAMS AND PARTS LIST				1	X	NO SK																																													
			D-12500701	B							NO SK																																													
			D-12500701	B																																																				
			D-12500701	B																																																				
			D-12500701	B																																																				
			D-12500701	B																																																				

71-NHTBA 0022-50

163-01-25

SAMPLE ORDER

ORDER NO: CD91-38

REQUEST DATE: 08/07/91

CREDIT ACCOUNT: 5902

COST CENTER: 101

PRODUCT CODE: 060

CUSTOMER: ITT TEVES
CUSTOMER P.O. NO: 14840
TI PART NO: 77PSL2-1
CUSTOMER PART NO: F2VC-9F924-AB
QUANTITY: 25

PRICE: \$12.00 EACH

DELIVERY PROMISED: ON OR BEFORE 8/16/91

SPECIAL INSTRUCTIONS:

BILL TO:
ITT TEVES
3000 UNIVERSITY DRIVE
AUBURN HILLS, MI 48321

SHIP TO:
ITT TEVES
3000 UNIVERSITY DRIVE
AUBURN HILLS, MI 48321
ATT'N: DIANE RICHARD

XX PRODUCTION SAMPLES

ENGINEERING DEVELOPMENT SAMPLES

CC: ENGINEERING: STEVE OFFILER

PRODUCTION CONTROL: MARIE CROSSLAND

SALES ENGINEER: JOE SCHUCK

TI-NHTSA 002251

-MSG K# 357969 FR-SBO1 TO-PCQA SENT-08/08/91 02:31 PM
R#-125 ST-C DIV-0050 CC-00101 BY-SBO1 AT-08/08/91 02:31 PM

TO: Jim Watt
Donna Moynihan

PCQA
PCQA

FR: Steve Offiler ✓ SBO1

SJ: Millivolt Drop Testing w/ Production Equipment

*Ford
Cruise Control*

As discussed at the startup meeting this morning, the QC Inspector's equipment is fixed at a test current of 35 milliamps whereas the CCPS devices are spec'ed at 750 mA. This will not be a problem if millivolt drop is a purely resistive phenomenon that conforms to Ohm's Law. In this case, we will simply redefine the maximum mV drop (at 35 mA) that corresponds to our spec. of 200mV at 750 mA. (This works out to 9.3 mV). We will, however, need to provide an actual mV readout rather than the present go/no go indicator light.

However, I am not convinced that mV drop across a set of contacts conforms ideally to Ohm's Law. (For example, contaminant films which contribute to resistance typically have some voltage dependence, where above some value the film breaks down and the resistance falls drastically.) I am planning to perform an experiment to develop some correlation between a test run at 750 mA and a test run at 35 mA. When complete, I hope we'll be able to arrive upon a suitable mV drop test procedure which allows use of the present equipment. Modifications, if needed, will be better understood after this experiment.

Regards,
Steve O.

*- Are Switcher Helms -
✓ Jim Watt*

TI-NHTSA 002252

HIGHLIGHTS

Stephen B. Offiler
Week Ending 91-08-09

Handwritten signature



FORD MY'92 ELECTRONIC SPEED CONTROL DEACTIVATE PS

VALIDATION:

Parts were delivered to the Chem Lab on-schedule for the critical-path Fluid Resistance Test. The Thermal Cycle test is presently underway, running both PC and LT parts simultaneously. This test takes approx. 5 working days to complete and utilizes the CCPS cycler. We are trying to expedite this test by coming in after hours, etc. because it is imperative that we complete it so we may begin the first phase of impulse testing as soon as possible. We are using impulse as a "design confirmation" test, primarily to ascertain whether the present state of the Eastern Automation movable terminal subassemblies is acceptable. Of greatest interest is the spring angle, which is running too high and is difficult to adjust.

We are experiencing difficulties obtaining some components of the offset-key mating connectors from UTA. A couple weeks ago, we requested and received NAC the connector shells, which came with all required seals. These were required for the Fluid Resistance Test, which needs environmental seals but not electrical connections. Now, we need to proceed with other tests which do need the electrical connections, but UTA sales rep's (Beth Morris and John Kilpatrick of UTA Huntington, IN) can't seem to find which terminals belong with this connector. I have attempted to enlist the aid of Bruce Pease, and Chuck Wilson (UTA Field Sales in Dearborn) to no avail thus far. Our backup plan, in order to stay on the tight validation schedule, will be to cut off the polarity keys so any mating connector will fit.

MECHANIZATION:

We're presently working on determining the accuracy of the check station, and the discrepancies between it and the calibrator. The calibrator in measure-only mode is producing commendable measurement repeatability, with sigma's on the order of several hundredths of a mil. The check station showed a downward trend over repeated measurements, indicating something mechanical is deforming or slipping. Mech. is addressing this issue now. Part-to-part and nest-to-nest accuracy tests are planned, as well as a final trial run of the entire switch assembly machine where any remaining glaring problems will be addressed before effectivity runs start. This run will also allow a statistically significant number of parts to be correlated with Jeff's manual measurements.

Dave Perpoll is presently working on the riveter of the EA equipment, converting from Milford driver and roll set to Thompson. Thompson is used on this particular rivet (74171) on the 52/57 production lines, and Dave is very familiar with these.

Claire Balthazar will be running an R&R on the 77PS pressure tester, including nest-to-nest variations, etc. She has requested that we stabilize and characterize 12 devices, twice each, so we have a set of "knowns" for her study. This will expand upon the initial correlation we already ran, which showed correlation coefficients of around 0.92, which is not very impressive.

MISCELLANEOUS:

I received a phone call from Stan Bragdon, the SAE J512 committee member who is handling our proposed change in J512 tolerances. He had good news to report. The ballot was passed by the subcommittee, which paves the way for the technical subcommittee to rubber-stamp it at their next meeting. If all goes well, the change will be published in the '92 Handbook.

-MSG # - 3929 FR-B512 TO-PCQA SENT-08/13/91 10:04 AM
R#-010 ST-C DIV-0050 CC-00561 BY-B512 AT-08/13/91 09:53 AM

To: NATT SELLERS
STEPHEN B. OFFILER
JIM WATT

MJS2
SBO1
PCQA

Copy: ED O'NEILL
WILLIAM SWERT

EJON
WSSO

From: GEORGE LAVOIE

B512

Subj: CCPS TERMINALS - K.F. BASSLER CO. - UPDATE

RICK BASSLER REPORTED TO ME THIS MORNING ON THE ACTION HE HAS TAKEN SO FAR TO REMOVE THE CONTAMINATION FROM THE CCPS MOVABLE AND STATIONARY TERMINALS.

SANDBLASTING - WORKED "OKAY" BUT CREATES DIVOTS WHICH WILL ENCOURAGE OXIDATION.

SCRUBBING - RICK TRIED BRUSH-SCRUBBING THE COILS WITH SEVERAL SOLUTIONS AND CLEANERS. NONE YIELDED POSITIVE RESULTS.

2.0 PH SOLUTION - RICK HAS PARTS SOAKING IN THIS SOLUTION WHICH IS SIMILAR TO A BRIGHT DIP. THE GREEN STAINS TURNED RED OVERNIGHT BUT THERE IS SOME IMPROVEMENT. RICK IS LEAVING THE PARTS IN THE SOLUTION TO SEE IF THE CONDITION WILL CONTINUE TO IMPROVE WITH TIME

TCE - RICK DIPPED THE PARTS IN TCE AND THERE WAS VERY LITTLE EFFECT.

RICK WILL VISIT GNF (GENERAL METAL FINISHING) THIS AFTERNOON TO CONSULT WITH THEM.

NATT AND STEVE, HAVE YOU CONSIDERED CONTACTING SOMEONE IN OUR METALLURGICAL LABORATORY? THEY HAVE PROVEN TO BE VERY HELPFUL IN SOLVING MANY COMPLICATED ISSUES IN THE PAST.

I WILL FURNISH MORE INFORMATION AS IT BECOMES AVAILABLE.

REGARDS,
GEORGE

Check Parts list
for 77P5 8/19/91

TI-NHTSA 002254

-MSG NO- 4860 FR-PCNK TO-PCQA SENT-08/13/91 10:10 AM
 RS-013 ST-C DIV-0050 CC-00101 BT-PCNK AT-08/13/91 10:10 AM

JULY 26, 1991

TO:	RUSTY STUBBLE	PC62	CC:	TOM CHANDONAT	TC
	NICK DeMATTIA	PCQA		JOHN KOUTSIS	NDS
	CHARLIE DOUGLAS	CPFC		STEVE MAJOR	WELA
	DICK GARIFFY	NYPC		ANDY McGUIRK	PCQA
	PAUL KOTCH	PRK1		ED O'NEILL	BJON
	JOE LANARS	JNLS		JOE SCHUCK	WELA
	STEVE OFFILER	SB01		GARY SWYDER	CPFC
	MATT SELLERS	PCNE		MARTHA SULLIVAN	CPFC
	BILL SWEET	PCNE		RAY TOURANGEAT	PCNE
	JIM WATT	PCQA		TED BALLARD	AFNE
	TED BRECHTEN	PRNT		STAN BOWDL	SE2
				CLAIRE BALTRAKAN	PRNT
				BILL CONDON	NYPC
				STEVE MCCOONT	NDS
				TERRY RODRIGUES	NYPC
				DONNA MOWHAN	PCQA
				PAUL WESTERLIND	BS11

FR: DAVE CHARN EARN

SJ: FORD CRUISE CONTROL PRESSURE SWITCH START-UP MEETING:
 08/08/91 MEETING MINUTES

MEETING

THE NEXT MEETING IS SCHEDULED FOR:

DATE: 08/15 (THURSDAY)
 TIME: 10:00 - 11:30 AM
 PLACE: MARKETING CONFERENCE ROOM

PLEASE CALL ME IF YOU ARE NOT ABLE TO ATTEND

* = ITEMS THAT ARE NEW OR HAVE BEEN REVISED OR COMPLETED
 SINCE PREVIOUS MEETING

57 L/T (LS-2)

Report:

	WHO	WHEN	
* REPORT ON ELCO ISSUES FROM 7/22 VISIT	ROTCB	ONGOING	
- 10821 STEEL/.00015" MIN. FLAT/7312 \$/ THREAD CHAMP. ANGLE/THREAD CAP			
* CONFERENCE CALL TO ELCO ON ISSUES FROM 7/22 MEETING RE:FI	ROTCB/ OFFILER	08/12	
* REVISED REPORT-PRINT W/ RADIOS ON DOGPOINT DIAMETER	OFFILER	07/11 08/22	ORIG. REV.

ISR Issues:

. RELEASE PRINT FROM L/T	SCHUCK	05/09 08/01 08/01	ORIG. REV. COMP.
. SUBMIT ISR FOLLOW-UP TO FORD SQA (NEED RELEASE PRINT)	WATT	04/04 08/12	ORIG. REV.

57 P/C (LS-3)

Environmental Seal:

* DETERMINE BEST WAY TO DIFFERENTIATE P/C AND L/T ENV. SEALS (COLOR, STRIPES...)	SELLERS	08/08 08/15	REV.
* DEFINE GAGING TORQUE	WATT	06/20	ORIG

TI-NHTSA 002255

SPEC W/J. HUTCHISON (PITTS)

08/15 REV.

77PS

PROD. LINE SET-UP (MTE CARDS, ETC)	BALTHASAR	ONGOING	
UPDATE PRODUCTION PLANS FOR ALL SWITCHES	DOUGLAS	ONGOING	
REVIEW 77PS S/U TIMING WITH PURCHASING	DOUGLAS	08/01	ORIG.
		08/01	COMP.
* 77PS HIS PARTS LIST	OFFILER	06/06	ORIG.
		08/01	REV.
		08/01	COMP.
* COMPLETE DESIGN FMEA	OFFILER	04/18	ORIG.
		08/15	REV.
* COMPLETE PROCESS FMEA	SELLERS	07/01	ORIG.
		08/15	REV.
* IS CALIBRATION ACCURACY ACCEPTABLE	OFFILER/	08/08	ORIG.
W.R.T. DEVICE PERFORM. AND MFG. YLDS ?	SELLERS	08/22	REV.
* 77PS DESIGN CONFIRMATION TEST	OFFILER	06/20	ORIG.
		08/16	REV.
. MFG. TO REVIEW ARM GAGING TECHNIQUE	SELLERS	08/01	ORIG. <i>prototype</i>
		08/15	REV. <i>947C set.</i>
. COMPLETE E.A.N. STAKER MODIFICATION	SELLERS/	07/31	ORIG.
	MCCOONT	08/15	REV.
. 57 TO 77 CONVERSION: PHASE 1 TESTING	BONOL	05/30	ORIG.
		09/00	REV.
* HOLD SEPARATE WEEKLY MFG. START-UP MTGS.	SELLERS	ONGOING	

QA Items:

77PS QAS (FINAL) <i>retype</i>	WATT	08/01	ORIG.
		08/15	REV.
. 77PS CHARACTERISTICS SHEETS <i>retype</i>	WATT	07/15	ORIG.
		08/15	REV.
. GAGE R&R STUDIES	WATT	07/15	ORIG.
		09/03	REV.
. 10KPSI GAGE FOR BURST TESTER	WATT	08/01	
		08/08	COMP.
. SCHED. TO COMPLETE QC P-TESTER	WATT	07/28	
		08/08	COMP.
* IDENTIFY ANY OTHER ITEMS THAT NEED TO BE COMPLETED FOR 9/20 ISR SUBMISSION	WATT	08/01	
		08/08	COMP.

PV Testing:

COMPLETE TESTING AND REPORT	OFFILER	09/16	ORIG.
		09/20	REV.

Production Components:

RESOLVE OPEN ISSUES ON BASE (FOOSHOT DUE TO STAKER EVAL.)	SELLERS	04/11	ORIG.
		08/22	REV.
* INVESTIGATE C.E. IDEAS FOR ENV. SEALS ON MANDRELS (...REUSABLE MANDRELS, ETC.)	SELLERS	08/08	
		08/08	COMP.
* EXPEDITE LOT OF ENV. SEALS ON MANDRELS	WESTERL.	07/26	
		08/08	COMP.
* SORT EX3355-97 GASKETS (ROUNDRNESS)	BALTHASAR	08/01	
		08/01	COMP.

Manufacturing Equipment:

FINAL ASM MACHINE DEBUG COMPLETION	SELLERS/	06/03	ORIG.
	KOURTESIS	08/02	REV.
		08/08	COMP.
. BASE ASM MACHINE BUILD COMPLETION	SELLERS/	05/31	ORIG.
	KOURTESIS	08/15	REV.
. PRESSURE TESTER BUILD COMPLETION	SELLERS/	06/20	ORIG.
	KOURTESIS	08/01	REV.
		08/01	COMP.
* ESTABLISH CRITERIA FOR EFFECT. RUNS	SELLERS	07/25	ORIG.

		08/01	REV.
. B.A.N. EFFECTIVITY RUN #1	SELLERS	08/08	COMP.
		07/03	ORIG.
. P.A.N. EFFECTIVITY RUN #1	SELLERS	08/15	REV.
		07/03	ORIG.
. EQUIP. MOVE TO B12	SELLERS	08/15	REV.
		09/12	

Tokico:
 . REPORT ON TORICO P.S. DOUGLAS ONGOING

DISCUSSION

ELCO WILL BE RUNNING A LOT OF 5K PARTS WITH REDUCED PLATING THICKNESS. TIMING ON RECEIPT OF THESE PARTS IS TBD.

WINGS PLATFORM AT FORD WILL BE REQUIRING A UNIQUE PART NUMBER. REASONING BEHIND THIS IS THAT WINGS IS A L/T PLATFORM WHICH WILL BE USING A SWITCH WITH A P/C CALIBRATION.

IT HAS BEEN DETERMINED THAT THE ENVIRONMENTAL SEALS ARE BEING DAMAGED DURING REPACKAGING AT TI. EFFECTIVE IMMEDIATELY, WE WILL REPACKAGE INTO SMALLER LOTS IN AN EFFORT TO AVOID DAMAGE.

PRODUCTION PLAN WILL BE REVISED FROM WHAT IS SHOWN BELOW IN THE NEXT TWO WEEKS BASED ON INPUT FROM MARKETING ON CUSTOMER REQUIREMENTS.

MILESTONES	PLANNED	ACTUAL
57 L/T ISIR	11/21/90	11/21/90
57 L/T JOB 1	09/03/91	
57 P/C ISIR	01/15/91	01/15/91
57 P/C JOB 1	06/03/91	
77PS ISIR	09/01/91 ORIG.	
	09/20/91 REV.	
77PS SOP (TI) est.	08/91	

PRODUCTION PLAN BY MONTH (THOUSANDS) - WITHOUT OVERAGE

	P/C 57PCL5-3	L/T 57PCL5-2	P/C 77PCL2-1	L/T 77PCL2-3
APR	0	0	0	0
MAY	2 (COMP.)	2	0	0
JUN	0	0	0	0
JUL	0	2.3	0	0
AUG	0	2.3	10	20
SEP	10	2.0	0	0
OCT	0	0	* 9 ?	* 12.5
NOV	0	0	25 ?	12.5
DEC	0	0	25 ?	12.5

* = TENTATIVE JOB1 FOR 77PS VERSIONS

REGARDS,
 DAVE CERN 133-FORD

CCPS

1-ORC

15/3 Different Enviro. Seal ?? * Change the
w/ty ?? * Change Parts List
P/C

(All 52 + 57 have used the same)

* Gaging torque ref. GM 6102

* 57's in prod. by early Sept.

77's mid to late Oct. 20-25K/man. P/C

(Crown Vic. Grand Marquis)

6-7K/man. 1/3

K-H ship

150

P/C

77's

for

2-26-91

* PV testing

1. failure on Imp. test (leaker)

what to do? (P/C device)

8 wks from rebuild to complete

a patent

✓ * Q101 - reference ↑ ? what to do? } Steve to
for
for Steve

✓ * Need Calibration sticker on 10K gage!
on Eric

DIEMASTERS

CERTIFICATE OF CONFORMANCE

SHIP TO:

TEXAS
INSTRUMENTS



FROM
Diemasters Manufacturing, Inc.

787 Industrial Drive
Elmhurst, Illinois 60126

DATE SHIPPED: 6-18-91

PURCHASE ORDER #: 5000088

SHIPPING OR INVOICE NUMBER: 60181

MATERIAL TRACE NUMBER (P.O. # HEAT LOT, OR ROUTE SHEET NUMBER): 65-7196

QUANTITY SHIPPED: 75,790

PART NUMBER: 27639-1

REVISION: D

PART DESCRIPTION: WASHER

OPERATION PERFORMED: MANUFACTURING

SPECIFICATION: 27639-1

REVISION: D

THE MATERIAL DESCRIBED ABOVE WAS PROCESSED, INSPECTED AND FOUND TO CONFORM TO THE DRAWING(S) AND SPECIFICATION(S) LISTED.

Phil Meyer
QUALITY CONTROL

08-14-91
DATE

ENCLOSURES: ☒ CERTIFICATE OF RAW MATERIAL

TRACEABLE LOTS 79

☐ INDEPENDENT LABORATORY TEST REPORT OF RAW MATERIAL

☐ INSPECTION REPORT(S)

☒ SUB ^{TEST TEST} ~~DATING~~ SUPPLIER'S CERTIFICATION(S) OF CONFORMANCE

☐ FORM _____ NON-CONFORMANCE RELEASED BY: _____

☐ DELETED FROM LISTING

TI-NHTSA 002258

-MSG N#- 79959 FR=SBO1 TO=PCQA SENT=08/15/91 12:46 PM
R#089 ST=C DIV=0050 CC=00101 BY=SBO1 AT=08/15/91 12:46 PM

TO: Joe Schuck WHLZ

CC: Dave Charn EARN Stan Homol SH2
Mike DeMattia PCQA Donna Heynihan PCQA
Jeff DiDomenico ELB Elaine Rose PCQA
Charlie Douglas CPFC Matt Sellers PCME
Bob Duffy PCQA Jim Watt PCQA

FR: Steve Offiler SBO1

SJ: 77PSL2-1 (Pass Car) Production Validation Failure

A device has failed the Impulse portion of the PV test. The failure mode is leakage due to ripped Kapton seals. The cause of the failure is still under investigation.

The Engineering Specification (ES-F2VC-9F924-AA) states very specifically on p13, Sect. IV A, that all samples tested must pass. Now, since all samples have in fact not passed, the primary question to be answered is what actions are required to remain in compliance with Ford policy. Do we re-run the entire PV test from scratch, or re-run just the Impulse portion? Secondly, is there any additional red tape we must deal with, for example an RMR-type failure analysis. We've looked quickly through Ford's quality documents (Q-101 and The Initial Sample Review Process), but did not find any specific information.

Re-running the entire PV test will require exactly nine weeks and one day after we rebuild 72 test devices; this gives an ISR submission date of 91-10-25 if we begin immediately. It is impossible to compress this timing unless the Fluid Resistance test (Sect. III N) is modified or eliminated. On the other hand, re-running just the Impulse test takes about 3 days and will not adversely affect the present schedule which is due for completion 91-09-20.

Joe, sooner or later we need to approach Ford to answer the above questions. The general feeling is that we (you) should carefully approach the release engineer on the lead Pass Car platform, Judy Simmons, doing your best to downplay the criticality of the situation and striving to win her approval to re-run just the Impulse test. Of course, people such as Bruce Pense, Scott Kusch (SOA) etc. will need to be clued-in at some point; we're just concerned about Ford taking an ultra-conservative position. Please contact me ASAP with your thoughts on this matter.

Regards,
Steve O.

TI-NHTSA 002260

-MSG #4- 84298 FR=DANX TO=PCQA SENT=08/15/91 02:24 PM
R#104 ST=C DIV=0050 CC=00101 BY=DANX AT=08/15/91 02:24 PM

AUGUST 15, 1991

TO: RUSTY STRUBLE	RCS2	CC: TOM CHARBONNEAU	TC
MIKE DeMATTIA	PCQA	JOHN KOURTESIS	NDES
CHARLIE DOUGLAS	CPFC	STEVE MAJOR	WELI
DICK GARIEPY	MFPC	ANDY McGUIRK	PCQA
PAUL KOTCH	PRKI	ED O'NEILL	BJON
JOE LASARE	JHL8	JOE SCHUCK	WELS
STEVE OFFILER	SE01	GARY SNYDER	CPFC
MATT SELLERS	PCNE	MARTHA SULLIVAN	CPFC
BILL SWEET	PCNE	RAY TOURANGEAU	PCNE
JIM WATT	PCQA	TED BALLARD	AVNE
TED BREDIXEN	PSWT	STAN MONOL	SH2
		CLAIRE BALTHASAR	PSWT
		BILL CONGDON	MFPC
		STEVE MCCOCHY	NDES
		TERRE-RODTONS	MFPC
		DONNA MOYNISAN	PCQA
		PAUL WESTERLYND	B511

FR: DAVE CARRN EARN

SJ: FORD CRUISE CONTROL PRESSURE SWITCH START-UP MEETING:
08/15/91 MEETING MINUTES

MEETING

THE NEXT MEETING IS SCHEDULED FOR:

DATE: 08/22 (THURSDAY)
TIME: 10:00 - 11:30 AM
PLACE: MARKETING CONFERENCE ROOM

PLEASE CALL ME IF YOU ARE NOT ABLE TO ATTEND

* - ITEMS THAT ARE NEW OR HAVE BEEN REVISED OR COMPLETED
SINCE PREVIOUS MEETING

57 L/T (LS-2)	WHO	WHEN	
Report:			
* REPORT ON ELCO ISSUES FROM 7/22 VISIT	KOTCH	ONGOING	
- 10821 STEEL/.00015" MIN. PLATE/JS12 S/ THREAD CHAMP. ANGLE/THREAD CAP			
* CONFERENCE CALL TO ELCO ON ISSUES FROM 7/22 MEETING AT FY	KOTCH/ OFFILER	08/12	COMP.
* PRESENT FOLLOW-UP TIMETABLE ON ELCO ACTION ITEMS	KOTCH	08/22	
* REVISED REPORT PRINT W/ RADIUS ON DOGPOINT DIAMETER	OFFILER	07/11 08/22	ORIG. REV.

ISR issues:

* SUBMIT ISR FOLLOW-UP TO FORD SQA (NEED RELEASE PRINT)	WATT	08/06 08/12 08/12	ORIG. REV. COMP.
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TI-NHTSA 002261

57 P/C (LS-3)

Environmental Seal:

* DETERMINE BEST WAY TO DIFFERENTIATE P/C AND L/T ENV. SEALS (COLOR, STRIPES...)	SELLERS	08/08	ORIG.
* DEFINE GAGING TORQUE	WATT	08/22	REV.
SPEC W/J. HUTCHISON (PITTS)		06/20	ORIG.
		08/15	REV.
		08/15	COMP.

77PS

. PROD. LINE SET-UP (RTE CARDS, ETC)	BALTHAZAR	ONGOING	
. UPDATE PRODUCTION PLANS FOR ALL SWITCHES	DOUGLAS	ONGOING	
* COMPLETE DESIGN FMEA	OFFILER	04/18	ORIG.
		09/04	REV.
* COMPLETE PROCESS FMEA	SELLERS	07/01	ORIG.
		09/06	REV.
* IS CALIBRATION ACCURACY ACCEPTABLE W.R.T. DEVICE PERFORM. AND MFG. YLDS ?	OFFILER/	08/08	ORIG.
	SELLERS	08/22	REV.
* 77PS DESIGN CONFIRMATION TEST	OFFILER	06/20	ORIG.
		08/16	REV.
. COMPLETE B.A.N. STAKER MODIFICATION	SELLERS/	07/31	ORIG.
	MCCOKEY	08/22	REV.
. 57 TO 77 CONVERSION: PHASE 1 TESTING	BOMOL	05/30	ORIG.
		09/--	REV.
* HOLD SEPARATE WEEKLY MFG. START-UP MTGS.	SELLERS	ONGOING	

QA Items:

. 77PS QAS (FINAL)	WATT	08/01	ORIG.
		08/22	REV.
. 77PS CHARACTERISTICS SHEETS	WATT	07/15	ORIG.
		08/22	REV.
. GAGE R&R STUDIES	WATT	07/15	ORIG.
		09/03	REV.

PV Testing:

. COMPLETE TESTING AND REPORT	OFFILER	09/16	ORIG.
		09/20	REV.

Production Components:

. RESOLVE OPEN ISSUES ON BASE (PUSHOUT DUE TO STAKER EVAL.)	SELLERS	04/11	ORIG.
		08/22	REV.

Manufacturing Equipment:

. BASE ASN MACHINE BUILD COMPLETION	SELLERS/	05/31	ORIG.
	KOURTESIN	08/22	REV.
. B.A.N. EFFECTIVITY RUN #1	SELLERS	07/03	ORIG.
		08/22	REV.
. P.A.N. EFFECTIVITY RUN #1	SELLERS	07/03	ORIG.
		08/22	REV.
. EQUIP. MOVE TO B12	SELLERS	09/12	

Tokico:

. REPORT ON TOKICO P.S.	DOUGLAS	ONGOING	
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DISCUSSION

45K STATIONARY TERMINALS AND 27K MOVABLE TERMINALS WERE REJECTED DUE TO STAINING CAUSED BY A LUBRICANT PROBLEM AT BASSLER. BASSLER IS NOW IN PROCESS OF CLEANING PARTS (VERY HIGH PROBABILITY PARTS ARE SALVAGABLE). IF CLEANING IS A PROBLEM, WE WILL HAVE A SERIOUS PROBLEM AS WE CANNOT GET NEW MATERIAL IN UNTIL OCTOBER.

NEXT WEEK, A RUN OF 250 PARTS WILL BE MADE TO GAIN A BETTER UNDERSTANDING OF CALIBRATION ACCURACY ACCEPTABILITY.

WE HAD A P/C DEVICE FAILURE DURING THE IMPULSE TEST ON D/V PARTS. WE PLAN TO CONTACT THE BRAKE ENGINEER ON THE LEAD P/C PLATFORM TO DETERMINE IF WE NEED TO START D/V TESTING FROM SCRATCH (WHICH WOULD PUSH OUT ISIR COMPLETION UNTIL MID/LATE OCTOBER) OR IF WE CAN DETERMINE CAUSE AND MOVE FORWARD FROM IMPULSE TEST.

PRODUCTION PLAN REVISED AS FOLLOWS:

MILESTONES	PLANNED	ACTUAL
57 L/T ISIR	11/21/90	11/21/90
57 L/T JOB 1	09/03/91	
57 P/C ISIR	01/15/91	01/15/91
57 P/C JOB 1	06/03/91	
77PS ISIR	09/01/91 ORIG.	
	09/20/91 REV.	
77PS SOP (TI) est.	08/91	

PRODUCTION PLAN BY MONTH (THOUSANDS) - WITHOUT OVERAGE

	P/C 57PSLS-3	L/T 57PSLS-2	P/C 77PSLS-1	L/T 77PSLS-3
APR	0	0	0	0
MAY	2 (COMP.)	2	0	0
JUN	0	0	0	0
JUL	0	2.3	0	0
AUG	0	2.3	0	0
SEP	25	16.0	25	12.5
OCT	0	0	20	12.5
NOV	0	0	25	12.5
DEC	0	0	25	12.5

* = TENTATIVE JOB1 FOR 77PS VERSIONS

REGARDS,
DAVE CHARN \34-FORD

8-15-91

CCPS

FORD

15.3 Different Enviro. Seal ?? * change Etc
w/ty ?? * change Parts List
etc

(all 5.2 + 5.7 HAVE USED the same)

* Gaging torque ref. GM 6102

* 5.7's in prod. by early Sept.

7.7's mid to late Oct. 20-25 K/mom. P/c
(Crown Vic. Grand Marquis) 6-7 K/mom. W/T

K-H ship 150 P/c 7.7's for 8-26-91

* P.V. testing

1 failure on Imp. test (leaker)
what to do? (P/c device)

8 wks from rebuild to complete
a retest

* Q101 reference ↑? what to do? {STEVE to
can
JOE check

* Need Calibration sticker on 10K gage!
see Eric

TI-NHTSA 002264

PRESSURE SWITCH DATA

FORM 21605

TEST NO. 77-1-31104

DEVICE 77PS	DATE REQUESTED	REQUESTED BY M. Sellers	REQUESTED COMPL. DATE
PERFORMED BY C. Salazar	DATE STARTED	DATE COMPLETED	APPROVED BY
PROJECT TITLE:			

CUSTOMER:

PURPOSE OF TEST:

Catiblish Pressure Tester
Summary sheet

PROCEDURE:

- * Serialize Pen 1 thru 10
- * Serialize Tests 1 thru 12
- * Rotate Pen in sets of 4 thru each set of 4 vents
- * 10 readings in each set of 4 vents on each set of 4 devices

	Rot.				R.L.			
	T	F	R		T	F	R	
#1	117.3	.7214	2.1		40.2	.90016	10.8	
	118.6	.74548	2.2		41.3	.7722	9.1	
	114.9	.6859	5.5		41.4	.11288	2.6	
#2	116.0	.9039	1.2		51.4	.2182	.7	
	119.1	.9619	2.9		53.7	.5817	1.7	
	116.5	.6844	2.5		53.1	.5831	1.9	
#3	117.3	.7616	2.2		46.6	.4360	1.5	
	118.5	.8054	2.3		48.5	.3709	1.3	
	117.1	.5845	2.4		47.9	.3961	1.2	
#4	104.7	.5455	1.5		40.2	.9891	10.8	
	105.9	.7816	2.6		42.5	.2482	.7	
	104.4	.9	2.9		42.6	.3579	1.1	
#5	118.3	.6309	1.9		44.9	.4005	1.4	
	116.4	.8055	2.5		45.1	.3524	1.2	
	115.5	.4005	1.4		44.9	.4801	1.6	
#6	105.8	.5219	1.7		41.7	.4247	1.7	
	104.7	.5594	2.0		41.4	.1098	9.9	
	102.4	.6442	2.4		41.8	.9743	10.3	
#7	126.9	.6039	1.8		56.1	.4482	1.7	
	123.4	.3979	1.0		56.4	.6905	2.5	
	121.8	.5478	1.6		55.7	.4755	1.5	

TI-NHTSA 002285

PRESSURE SWITCH DATA

Form 21605

TEST NO. 77-1 *Page 2/4*

DEVICE <i>7705</i>	DATE REQUESTED	REQUESTED BY <i>M. Salazar</i>	REQUESTED COMPL. DATE
PERFORMED BY <i>C. Salazar</i>	DATE STARTED	DATE COMPLETED <i>8-15-91</i>	APPROVED BY
PROJECT TITLE:			

CUSTOMER:

PURPOSE OF TEST:

Citibank Machine -

PROCEDURE:

Test 1-4 repeated then test 1-12 10 of 4

TI-NHTSA 002267

	Ac. t					Rel			
	1	2	3	4	Leak Rate	1	2	3	4
* 1-4 <i>1st</i>	118.2	116.1	118.2	105.3	9.1	41.2	51.8	42.6	41.4
<i>next</i>	118.1	116.7	118.1	105.4	9.4	41.4	51.4	42.0	41.6
* 1-4	117.2	115.5	118.0	105.4	8.8	41.0	51.7	42.0	41.0
	117.2	115.8	117.9	105.0	9.0	41.1	51.4	41.6	41.1
	116.8	116.0	117.5	105.5	9.8	41.8	51.2	41.4	41.3
	116.7	116.3	116.7	105.6	9.4	41.7	51.3	41.7	41.0
	116.4	116.1	116.4	104.6	9.7	40.9	51.1	41.4	40.6
	116.1	116.1	116.7	104.1	9.5	40.7	51.5	41.3	40.9
	117.6	116.0	116.0	104.0	9.5	41.3	51.6	41.7	41.0
	118.2	115.8	116.6	103.9	9.5	40.6	51.3	41.2	40.8
X	117.3	116.0	117.2	104.7		40.2	51.4	41.6	40.3
S	174.4	303.9	76.16	154.5		301.76	31.23	48.60	2.9841
R	2.1	1.9	2.2	1.5		10.2	.7	1.5	10.7
	115.9	118.0	119.5	107.1	8.5	42.5	54.9	49.2	42.9
* 1-4	115.9	119.2	118.2	106.9	9.8	42.0	54.4	48.6	42.7
10-5000	117.3	118.1	119.5	106.7	8.0	41.6	53.6	48.8	42.6
5-8	119.3	116.9	119.3	106.3	9.8	41.2	53.4	48.7	42.5
	120.0	116.9	118.6	105.8	9.4	41.2	53.4	48.2	42.4
	120.1	115.8	118.3	105.4	8.5	41.8	53.4	48.4	42.5
	121.4	116.4	117.8	105.7	8.5	41.7	53.3	48.6	42.8
	122.1	116.3	117.8	105.7	6.7	39.4	50.1	47.8	42.4
	121.7	116.9	117.7	104.5	9.9	41.3	53.0	48.5	42.8
	122.5	116.8	118.0	105.1	9.6	40.9	53.4	48.3	42.2
X	119.6	117.1	118.5	105.9		41.3	53.7	48.5	42.5
S	2.4542	961.3	208.4	76.16		779.3	58.17	370.7	2.4722
R	2.2	2.9	2.3	2.6		3.1	1.9	1.3	.7

(OVER)

Act.

Rel

	1	2	3	4	LEAD Race	1	2	3	4
1-4	118.4	112.1	118.5	108.8	9.9	49.9	53.4	48.8	42.7
9-12	114.1	116.2	117.4	105.5	9.2	41.5	53.6	46.0	42.6
	118.1	115.9	117.0	105.3	9.7	41.4	53.9	48.9	44.5
	117.2	116.1	117.0	104.7	9.8	44.1	53.9	47.6	41.7
	117.0	115.9	117.0	104.5	7.9	41.1	53.0	47.9	43.4
	116.7	116.7	116.7	104.2	8.7	41.0	53.0	47.9	42.0
	116.7	116.7	116.7	104.0	8.0	41.9	52.9	47.6	42.0
	117.2	117.9	117.0	103.9	9.3	40.4	52.9	47.7	42.1
	118.9	116.9	117.0	103.8	9.8	40.7	52.9	47.6	41.9
	119.0	115.4	116.1	103.3	9.4	40.3	52.9	47.6	41.6
5	116.9	116.5	117.1	104.4		41.4	53.1	47.9	42.2
8	1.6857	1.6844	1.5845	.9		1.1072	.5841	1.5861	3.577
8	3.5	3.5	3.4	2.9		3.6	1.9	1.3	1.1
1-4	117.3	116.0	117.0	104.7		40.2	51.4	46.6	40.2
18	119.6	117.1	118.5	108.9		41.9	52.7	48.5	42.5
1-12	116.9	116.5	117.1	104.4		41.4	53.1	47.7	42.4
8	117.9	116.5	117.6	105.0		40.9	51.7	47.7	41.7

PRESSURE SWITCH DATA

FORM 21605

TEST NO. #77-1 19. 9/4

DEVICE 7795	DATE REQUESTED	REQUESTED BY M. Sellers	REQUESTED COMPLETION DATE
PERFORMED BY S. Salazar	DATE STARTED	DATE COMPLETED 9-15-91	APPROVED BY
PROJECT TITLE:			

CUSTOMER:

PURPOSE OF TEST:

Catalytic Converter

PROCEDURE:

Pos # 5-8 rotated thru pos 1-12 in set of 4

TI-NHTSA 002269

	ACT				LEAK	REL			
	5	6	7	8	Rate	5	6	7	8
5-8 IN	117.6	104.8	126.0	109.2	7.8	44.8	41.9	55.6	41.9
5-8 OUT	118.3	105.1	126.3	109.9	7.8	45.5	42.7	55.2	42.1
5-8 IN	119.2	106.4	127.8	111.3	9.5	45.0	42.4	56.9	40.1
5-8 OUT	119.2	106.0	126.5	111.8	8.4	45.1	41.4	56.3	42.7
	118.3	106.5	127.8	111.8	8.4	45.1	41.8	56.1	42.1
	118.4	105.6	126.9	110.6	8.2	45.0	41.6	56.1	42.1
	119.0	105.6	126.1	110.6	9.6	45.0	41.5	56.0	42.0
	117.3	105.8	127.2	110.3	9.9	45.1	41.8	56.4	42.4
	118.0	106.4	127.3	110.1	9.5	44.5	42.0	56.0	42.7
	117.9	105.9	127.1	110.3	9.8	45.2	41.5	56.5	42.6
X	118.3	105.8	126.9	110.5		44.9	41.7	56.1	42.7
Σ	626.5	531.9	612.9	586.35		400.5	427.7	447.3	475.4
R	1.9	1.7	1.8	2.6		1.4	1.7	1.7	1.5
5-8	114.7	106.0	123.8	110.4	8.0	45.9	42.2	58.0	43.8
5-12	117.5	105.2	123.8	111.9	7.6	45.1	42.5	56.9	43.6
5-12	116.8	104.9	123.8	112.5	8.1	45.2	41.8	56.8	43.5
	117.4	104.4	123.7	113.9	9.0	44.9	41.8	56.6	43.4
	117.0	104.9	123.4	114.2	9.0	45.0	42.2	56.5	43.5
	116.5	104.7	122.8	113.8	9.0	44.9	41.7	55.9	43.5
	115.9	104.3	122.2	115.1	8.7	44.9	41.6	56.0	43.5
	116.3	104.1	123.2	116.9	8.5	44.7	40.9	56.3	43.9
	115.7	104.0	123.0	116.3	9.3	45.1	41.4	56.7	43.9
	116.0	104.6	122.8	116.0	9.7	44.7	41.5	55.5	43.4
X	116.4	104.7	123.4	114.1		45.1	41.9	56.4	43.3
Σ	508.5	559.4	627.9	629.89		392.4	409.2	440.5	441.7
R	2.8	2.0	1.0	4.4		1.2	3.9	3.5	.9

201

B1

	5	6	7	8	LEAK RATE	5	6	7	8
5-8									
100 RESE	115.7	109.9	123.5	112.7	2.4	45.1	43.4	52.6	49.4
1-4	115.9	109.2	122.2	112.4	2.3	44.8	42.5	52.0	49.0
	115.4	109.1	122.6	112.6	2.1	44.7	42.0	52.0	49.9
	115.5	102.3	123.5	111.8	2.5	44.0	41.9	55.8	49.1
	115.5	102.3	121.7	112.2	2.8	44.1	41.2	55.2	49.2
	114.9	102.4	121.6	111.3	2.9	44.2	41.7	55.2	49.0
	115.1	101.5	121.5	111.7	2.2	44.5	41.7	55.2	49.1
	115.0	102.3	121.0	111.7	2.2	44.7	41.6	55.1	49.3
	115.1	101.1	121.3	111.0	2.3	44.4	41.5	55.9	49.2
	116.3	101.8	121.0	110.5	2.1	44.5	41.2	55.7	49.6
X	115.6	102.4	121.8	111.8		44.3	41.8	55.7	49.7
5	116.5	104.4	124.7	112.5		45.0	42.3	57.5	50.5
R	1.4	2.4	1.6	2.2		1.6	1.3	1.5	1.2
5-8	118.9	125.8	126.9	110.5		44.9	41.7	52.1	42.7
10	116.4	124.7	123.4	114.1		45.1	41.4	52.4	49.3
1-12	115.5	123.4	121.8	111.8		44.3	41.8	55.7	49.7
8	116.7	124.3	124.0	121.1		44.8	41.6	52.1	42.0

TI-NHTSA 002270

PRESSURE SWITCH DATA

Form 21605

TEST NO. 77-1 19-4-4

DEVICE 7705	DATE REQUESTED	REQUESTED BY M. Sellers	REQUESTED COMPL. DATE
PERFORMED BY C. Antkowiak	DATE STARTED	DATE COMPLETED 8-15-91	APPROVED BY
PROJECT TITLE:			

CUSTOMER:

PURPOSE OF TEST:

Catalytic Converter

PROCEDURE:

H-3 9-12 rotated thru ports 1-12 in vert of 4

TI-NHTSA 002271

	Net				LEAK RATE	Rel			
	9	10	11	12		9	10	11	12
H-3-12	119.2	101.0	116.5	114.0	2.0	43.9	39.2	41.2	48.5
10-12	117.1	102.4	115.7	114.1	2.7	43.6	38.3	41.7	48.3
9-12	117.4	102.8	115.9	113.7	2.0	42.9	38.4	41.7	48.5
	115.8	101.5	115.1	113.7	2.7	42.5	38.9	41.5	48.3
	115.3	101.8	115.3	113.4	2.5	42.7	38.7	41.3	48.6
	118.2	102.8	115.0	113.7	2.7	42.3	39.0	41.3	48.3
	118.8	101.1	115.4	113.2	2.6	42.8	38.4	41.4	48.3
	117.6	100.6	114.8	113.2	2.5	42.0	37.3	41.1	48.1
	119.1	99.9	114.1	113.0	2.6	42.0	37.5	40.4	48.0
	119.2	98.6	114.0	112.7	2.0	41.1	36.8	40.9	48.0
X	117.2	101.3	115.3	113.5		42.9	38.1	41.5	48.3
5	123.19	118.7	124.9	124.96		48.2	40.9	41.36	124.9
R	5.4	4.3	2.5	1.6		2.2	3.4	1.4	.5
H-3-12	119.7	99.5	113.9	112.2	2.2	42.7	39.8	42.4	48.7
10-12	120.1	99.7	113.8	112.3	2.5	42.6	38.7	41.8	49.1
1-4	121.0	99.6	114.1	112.3	2.7	41.8	38.5	41.4	48.7
	119.1	98.7	113.6	111.7	2.1	42.2	38.7	41.5	48.3
	119.5	98.4	112.7	111.5	2.5	41.3	39.1	41.1	48.1
	120.5	98.3	112.9	111.0	2.8	41.8	38.6	40.3	48.0
	119.8	98.1	113.0	111.1	2.7	41.7	38.9	40.7	48.9
	120.5	98.6	112.3	111.8	2.7	41.2	38.6	41.3	48.0
	120.4	98.7	113.7	111.1	2.6	41.8	38.6	40.8	47.9
	118.7	98.5	112.0	110.3	2.8	41.8	38.4	41.0	48.4
X	119.9	98.7	113.1	111.6		41.9	38.2	41.3	48.3
7	120.7	104.81	124.78	120.9		48.74	37.06	5.5	3.299
R	4.9	3.0	1.9	3.0		1.6	1.4	2.1	1.2

(OVER)

Det

Rel

	9	10	11	12	Rate	9	10	11	12
9-12	121.3	97.9	112.7	111.6	9.6	43.9	40.3	42.3	42.9
10-12	121.8	97.9	112.5	111.2	8.1	43.9	42.7	41.6	45.8
5-8	121.8	97.2	111.9	111.5	9.9	43.6	42.4	41.7	48.2
	121.4	97.7	111.9	110.9	8.9	43.2	42.3	41.4	48.1
	121.9	97.7	112.4	111.1	8.0	43.6	42.2	41.3	47.9
	121.8	97.4	112.0	111.1	8.5	43.9	45.4	41.2	47.5
	121.0	97.9	111.9	111.1	9.4	43.6	42.8	41.9	47.3
	121.0	97.9	111.9	111.2	8.0	43.6	42.4	41.9	47.7
	121.3	97.9	111.9	110.5	8.8	43.8	42.7	41.6	47.9
	121.0	97.0	111.7	111.8	8.6	43.0	42.9	41.5	47.7
T	121.3	97.9	112.6	111.1		43.2	40.0	41.2	42.0
T	130.8	120.2	132.4	127.1		52.0	1.94	51.1	47.1
R	.9	.8	1.4	1.1		1.9	6.7	1.8	1.6
9-12	117.2	101.8	115.2	119.5		42.9	38.1	41.3	45.3
10	119.9	97.7	112.1	111.6		41.9	38.8	41.3	46.8
1-12	121.3	97.9	112.0	111.7		42.2	40.0	41.6	48.0
3	119.5	99.3	113.4	112.1		42.7	39.0	41.3	48.2

CCPS

Ford

LS 3 Different Enviro Seal ?? * change EOL
P/C Wtly ?? * Change Parts List

(All 52 + 57 HAVE USED THE SAME)

* Gaging torque ref. GM 6102

* 57's in prod. by early Sept.

77's mid to late Oct. 20-25 K/min. P/C
(Crown Vic. Grand Marquis) 6-7 K/min. 1/T

K-H ship 150 P/C 77's for 8-26-91

* PV testing

1 failure on comp. test (leaker)
what to do? (P/C device)

8 wks from rebuild to complete
a retent.

1 * Q101- reference ↑ ? what to do? } Steve to
COA
JOE SHUCK

1 * Need Calibration stickers on 10K gage
see Eric

HIGHLIGHTS
Stephen B. Offiler
Week Ending 91-08-16

SEA
9/10/91



FORD MY'92 ELECTRONIC SPEED CONTROL DEACTIVATE PS

VALIDATION:

The Thermal Cycle test was successfully expedited in order to begin the important Impulse test as soon as possible. Half of the Impulse test is run on virgin devices, and the other half is to be run on parts which have completed the Fluid Resistance test. We are now running the virgin Pass Car and Light Truck parts simultaneously. A significant problem is occurring on the PC devices. We have had three failures to date (325K of 500K) due to fluid leakage. Autopsy of two (thus far) shows fatigued Kapton; no real evidence of foreign matter nor damage to the Kapton during assembly. Stan Homol is providing valuable assistance in failure analysis. Note that we are running AMI-built PC and LT side-by-side, with no failures of the LT parts, which is directing F/A toward the cap. We are continuing to run the test for two reasons: one, to attempt to complete the LT parts successfully; and two, to continue to fail PC parts to provide additional F/A clues. Hypotheses include: increased converter travel in the rebump design; extraordinarily tight sensor crimp as evidenced by the deformations where the Kapton layers overlap; very flat washers (unlike the norm, which is slightly cup-shape) which may also contribute to tight crimp. We are giving this matter top priority. At this point, it is safe to assume that the PC parts presently undergoing Fluid Resistance will also fail on Impulse. This means that after the problem is corrected, at the very least the Fluid Resistance test will need to be re-run, or at worst the entire validation will have to be re-run from scratch, which is about a nine-week process either way. We are now trying to determine how to best approach Ford with this news.

MECHANIZATION:

Mechanization has performed repeated measurements on the three AMI gage blocks and three switch assemblies, and Jeff has performed exactly the same measurements manually. The AMI calibrator (measure-only mode) and the check station produced commendable sigma's, although lack of agreement between the two requires more effort to understand. Jeff's measurements produced sigma's slightly worse than the automatic equipment. The good news is that it appears that a very good correlation exists between Jeff's manual measurements and the check station. We are planning a "pre-effectivity run" (a.k.a. "final debug run") of a few hundred switch assemblies, collecting all data on each piece and identifying each individually for later analysis. This will provide a statistically significant number of parts for check station vs. Jeff correlations, as well as allow Pareto analysis of problems which occur during the run.

Dave Peripoli has spent quite a bit of time working on the riveter on the Eastern Automation equipment. At present, we've got a hybrid of Milford and Thompson riveter parts, which seems to be running fairly well. However, for the long-term Mechanization is looking into elimination of the rivet. We are working with an ultrasonic welding firm, Supla, who has provided very impressive samples. I am meeting with them today to provide actual springs and movable terminals, so we can do actual in-product performance and life tests.

Progress on the above items is presently impacted by lack of terminals. We have 27K movables and 45K stationaries from Bassler which were rejected for contamination. The sticky green substance has been identified as the environmentally-friendly cleaner/rustproofing product (Imco 119) that Bassler uses to remove the EF stamping lube (Imco 185).

TI-NHTSA 002274

HIGHLIGHTS 910816

Page 2

Apparently he is not drying and/or removing this product correctly. Rick S. has determined that a phosphoric-acid tumbling product he uses regularly in-house will remove the green stains. We are having him expedite this cleaning process so we may continue with riveter work and the pre-effectivity run.

MISCELLANEOUS:

We have finally received the correct mating-connector terminals and wedges from UTA. The confusion was caused in part because this is a brand-new design and is not properly documented yet; additionally the correct individual who has knowledge of this product was out sick.

The hexport samples in 10B21 material have arrived. One has been sent to TSL for analysis of hardness, in the same fashion as done previously for a 10L10 part. This will allow direct comparison, in order to determine if the 10B21 is actually significantly harder. These parts, without re-roll, gaged very well - however, they were not plated in a 5K beach size, and they were packed individually for shipment. The hardness results, along with the quote, will help determine whether we will proceed with a full plating lot (5K).

-MSG N#- 107199 PR-DAH2 TO-PCQA SENT-08/16/91 09:36 AM
R#-140 ST-C DIV-0050 CC-00149 BY-DAH2 AT-08/16/91 09:36 AM

Memorandum
August 16, 1991

TO: Lou Roche MAYR
Steve Offiler SBO1

CC: Ted Bradekin PSWT
Charlie Douglas CPPC
Bob Duffy PCQA
Dick Garlepy MFPC
Donna Moynihan PCQA
Matt Sellers PCNE
Elaine Rose PCQA

FROM: Jim Watt PCQA

SUBJ: Ford Cruise Control 57PS Series Pressure Switch Inspection Tester

Please attend a short meeting on the 57PS tester in Bldg 12, 3rd floor,
(electrical off-line tester) to review the test algorithms on
Ford cruise control switches.

Date: Monday, August 19, 1991

Time: 1:30 p.m.

Place: Bldg. 12 Cafeteria

Regards,

Jim Watt MSG: PCQA Ext: 1719 N/S: 12-27

TI-NHTSA 002276

MEMORANDUM
16 AUG 1991

TO: GARY SNYDER
COPY TO: MARTHA SULLIVAN
FROM: YODEN CHENBURKAR

SUBJECT: HIGHLIGHTS FOR WEEK ENDING 09/16/91

ZUA. CONTACTED ZUA BUYER, HAL BUNZMANN, TO FOLLOW UP ON OUR PROPOSAL. AN INTERNAL ZUA MEETING IS BEING CALLED THIS WEEK TO DISCUSS OUR PROPOSAL AND THE JUST RECEIVED FASCO PROPOSAL. HE PROMISED TO GET BACK TO US VERY SHORTLY. HE WAS INTERESTED IN OUR EFFORTS TO CONTACT ATBUDI, SPECIFICALLY TOOLING. I INFORMED HIM OF OUR INITIAL QUERIES WITH ATBUDI AND THAT WE WOULD BE GIVING THEM A PRICING PROPOSAL IN THE NEAR FUTURE.

UTAO. WE HAVE AGREED TO START PROTOTYPE WORK WITH VX54 AND WORK TOWARDS A NOVEMBER DELIVERY. ENGINEERING RESOURCES WILL BE TIGHT AND BASED ON CONTINUATION OF THE ZUA PROGRAM, WE WILL NOT HAVE AN INDIVIDUAL TO WORK THIS PROGRAM.

20PS. THREE PLAININGS ARE BEING SALT SPRAY TESTED THIS WEEK AS THE ALTERNATIVE TO CURRENT SUPPLIER. AT LEAST ONE MUST MEET THE 168 HOUR SALT SPRAY IN ORDER FOR US TO AVOID SHUTTING CADILLAC DOWN.

CADILLAC. CADILLAC WILL BE VISITING TI OCTOBER 10 TO DISCUSS QUALITY ISSUES. WE ARE TRYING TO GET BAGINAM AND CPC TO COME TO THIS MEETING AS WELL TO GET ON CONSENSUS ON NEED TO MAKE DESIGN CHANGES TO SOLVE THE LEAKING AND BENT TERMINAL PROBLEM. IF THIS ISSUE GETS PUSHED BY CADILLAC (DAVE PORIER) WE WILL HAVE TO PULL THE JOINT MEETING SOONER.

VX54. LATEST DISCUSSIONS WITH FORD, CHRIS OEHNING, REVEALS THAT THEY NOW BELIEVE THE SWITCH WILL SEE AN ECM LOAD RATHER THAN A HIGH CURRENT CLUTCH LOAD. THIS MAY REQUIRE HAVING TO USE A LOW CURRENT CONTACT. ALSO THE QUALIFICATION TESTING AS PRESENTLY AGREED TO WOULD HAVE TO CHANGE. CHRIS WILL CONFIRM LOADING, WE WILL DETERMINE COST AND TESTING RAMIFICATIONS.

FMEA. MIKE DEMATTIA HAS INDICATED THAT QA WILL TAKE THE LEAD POSITION ON FACILITATING AND TYPING THE FMEA. WE AGREED UPON THE PRIORITY ON THE THREE REQUIRED FMEA'S. QA WILL BEGIN MEETINGS SHORTLY.

CHRYSLER LH POPS. CAME TO AN AGREEMENT WITH CHRYSLER AND UTA ON ISIR SUBMISSION DATES. WE ARE TO SUBMIT PACKAGE AS WELL AS 500 PARTS ON 1/4/92. WE ARE CURRENTLY ON TARGET TO MEET THAT DATE.

AUDI. HARRY HAS A MEETING WITH AUDI PURCHASING 9/27 TO DISCUSS LATEST ISSUES. APPARENTLY TIH OFFERED ENGINEERING THE FREE DISC W/FLYING LEAD CONCEPT EARLIER IN THE PROGRAM BUT AUDI ENGINEERING FELT IT WAS TOO RISKY AND ASKED TI TO QUOTE THE 20PS. AUDI ENGINEERING WILL BE AT THE MEETING TO ADD CREDENCE TO THAT LINE OF THOUGHT. POSITION AT THIS TIME IS TO PUSH THE 20PS AND CONCEDE THE LPCQ.

FORD LTA. RECEIVED REBUTTAL LETTER FROM FORD BUYER ON OUR LTA. KEY CONCESSIONS THEY ARE ASKING FOR IS ELIMINATION OF THE LABOR ND OVERHEAD CEILING AND MATERIAL ABSORPTION NOT TIED TO AN INDEX. RESPONSE AND REVISED LTA TO BE DELIVERED EARLY NEXT WEEK. TI-NHTSA 002277

**DRAWINGS AVAILABLE UPON
REQUEST**

DEVICE # 52/57PS
PROJ. # 3355

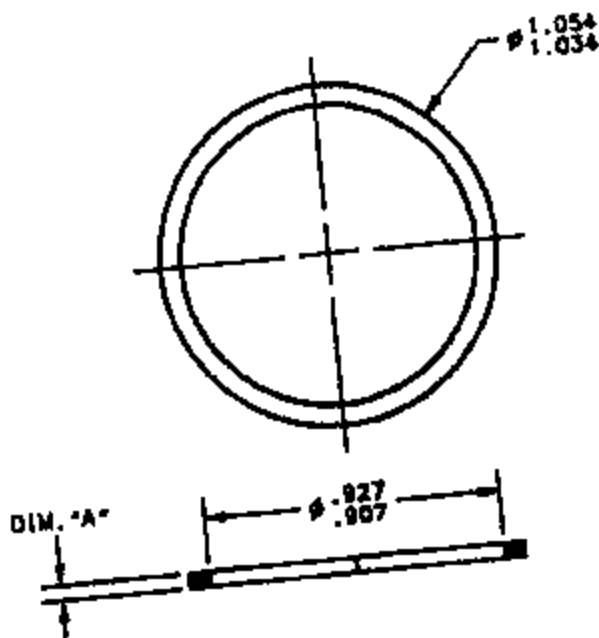
TITLE

ENVIRONMENTAL SEAL

REV
E

74247

74247



NOTES:

1. MATERIAL CERTIFICATION REQUIRED WITH EACH SHIPMENT.
2. 74247-3 IS TO BE RED IN COLOR WITH 3 BLACK MARKS ON THE EXTERNAL CIRCUMFERENCE AT 120° INTERVALS.

THIS DWG. SUPERSEDES 74247 REV. 'D' DATED 10-14-88

PART NO.	MATERIAL	DURUMETER	COLOR	DIM. 'A'
74247-4	SILICONE JBL (T-B-D)	55 - 65	BLUE	.045-.055
74247-3	SILICONE JBL 57424-8	55 - 65	SEE NOTE 2	.045-.055
74247-2	SILICONE JBL 57424-8	55 - 65	RED	.040-.050
74247-1	BUNA N JBL N7014-80	50 - 60	BLACK	.040-.050

1. ADD -3, -4 AND NOTE 2.
2. USED DIM. 'A' TO TABLE.
CR. 10/20/87, 10-1-81 CH

REV'D TOM DALL 8-18-91



TEXAS INSTRUMENTS
ATLANTA, GEORGIA 30343

ELIOT
GENERAL PURPOSE
CRYSTALLINE

A

74247

TI-NHTSA 00

August 20, 1991

To: Donna Moynihan 12-27

From: Beth Kill 10-16

Subject: GP-3 Material Confirmation
TSL Request # 110823

Sample Description:

P/N 36888-1 Stationary Terminal CDA 260 Brass
1/2 Hard

Results:

	P/N 36888-1	Spec. CDA 260
Cu (wt%)	68.5%	68.5 - 71.5%
Fe	0.030	0.05 max
Pb	0.010	0.07 max
Zn	balance	balance
Hardness	73 RB	60 - 77 RB

Results confirm the terminal is made of CDA 260 brass,
1/2 hard.

Regards,

Beth X3069

TI-NHTSA 002280

August 20, 1991

To: Donna Moynihan 12-27

From: Beth Kill 10-16

Subject: GP-3 Material Confirmation
TSL Request # 110824

Sample Description:

P/N 36887-1 Moving Terminal CDA 260 Brass
1/2 Hard

Results:

	P/N 36887-1	Spec. CDA 260
Cu (wt%)	68.7%	68.5 - 71.5%
Fe	0.020	0.05 max
Pb	0.010	0.07 max
Zn	balance	balance
Hardness	60.5 RB	60 - 77 RB

Results confirm the terminal is made of CDA 260 brass,
and slightly above 1/2 hard.

Regards,

Beth X3069

TI-NHTSA 002281

August 20, 1991

To: Donna Moynihan 12-27

From: Beth Kili 10-16

Subject: GP-3 Material Confirmation
TSL Request # 110825

Sample Description:

P/N 36889-1 Spring C17200 Beryllium Copper

Results:

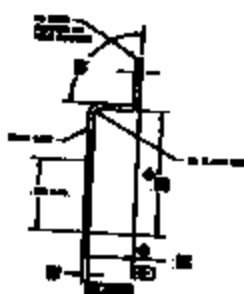
	P/N 36889-1	Spec. C17200
Be (wt%)	1.87%	1.80 - 2.00%
Fe	0.089	
Ni	0.068	[Fe + Ni + Co <0.6%] [Ni + Co >0.2%]
Co	0.220	
Hardness	300 DPH	285 - 343 DPH

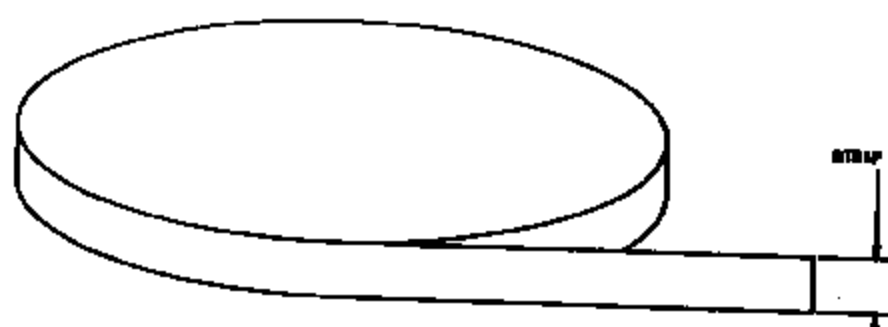
Results confirm the spring is made of C17200 beryllium copper at the specified hardness.

Regards,

Beth X3069

TI-NHTSA 002282

[illegible]



- NOTES:
1. MATERIAL CERTIFICATION INCLUDING TENSILE STRENGTH AND HARDNESS DATA REQUIRED WITH EACH SHIPMENT.
 2. EACH REEL TO BE LABELED WITH T.I. PART NUMBER ON INSIDE OF CORE.
 3. MAX. ALLOWABLE BULK .001.
 4. HELLS SLITTED FROM EDGE OF MASTER COIL NOT ACCEPTABLE.
 5. MIN. WEIGHT PER REEL IS 30 LBS.
MAX. WEIGHT PER REEL IS 10 LBS.
 6. REEL TO BE WINDING STYLE.
1 1/2" TO 1 3/4" ID.
3/4" DRIVE HOLE
 7. NO SPLICES ALLOWED.

CERTIFIED PRINT
JAN 30 1968 REV. E
JUL 1 1970

27716-1	REVELLON COPPER C12200, MILL HARDENED (BRASS YELLOW ALLOY 100 HB)	125-150	205-243	.008 ± .0007	.101-.125	TEM
PART NO	MATERIAL	MIN. TENSILE (101)	MIN. YIELD (80)	TENSILE ST (10)	STRIP WIDTH (.10)	FIN. FIN. UP (.00)

MATERIALS SECTION CONTROL NO. 11-16-70 RELEASED BY VERIFICATION REQUIRED		IN 11-16-70 1-1-71 1-1-71 1-1-71		TEXAS INSTRUMENTS SPRING MATERIAL STRIP SPECIFICATION		16374-1 SAUCON VERIFICATION REQUIRED	
11-16-70 1-1-71 1-1-71 1-1-71		11-16-70 1-1-71 1-1-71 1-1-71		11-16-70 1-1-71 1-1-71 1-1-71		11-16-70 1-1-71 1-1-71 1-1-71	
11-16-70 1-1-71 1-1-71 1-1-71		11-16-70 1-1-71 1-1-71 1-1-71		11-16-70 1-1-71 1-1-71 1-1-71		11-16-70 1-1-71 1-1-71 1-1-71	
11-16-70 1-1-71 1-1-71 1-1-71		11-16-70 1-1-71 1-1-71 1-1-71		11-16-70 1-1-71 1-1-71 1-1-71		11-16-70 1-1-71 1-1-71 1-1-71	

RHS DRAWING SUPPLEMENT 27716SH REV. A DATED: 11-16-70

TI-NHTSA 002205

**DRAWINGS AVAILABLE UPON
REQUEST**