

Markers (mounted & unmounted characters)

If you have any questions about the size characters you need or are looking for additional sizes and styles, please call our customer service department, or mail us a sample so that we may send you exactly what you're looking for.



UNmounted Lead Characters

style	(3/16")	(1/4")	3/8"	(1/2")	(5/8")	(1" R&L Only)	(1" arrow)
FLAT FACE	XTUF-36	XTUF-14	XTUF-38	XTUF-12	XTUF-58	XTUF-01	X
DEEP BLOCK	X	XTUB-14	XTUB-38	XTUB-12	(see Flat Face)	X	X
ARROWS	X	XTUA-14	X	XTUA-12	X	X	XTUA-01



Individual Mounted Characters (Flat Face)

Cat. #	lead/plastic size	Comments
XTSF-3658	3/16" on 5/8"	Fits: LLH-58, LLH-2, LLH-3, Veri-Thin
XTSF-3634	3/16" on 3/4"	Fits: Legal (regular)
XTSF-1458	1/4" on 5/8"	
XTSF-1434	1/4" on 3/4"	
XTSF-1478	1/4" on 7/8"	Fits: Eclipse, Perfection
XTSF-1234	1/2" on 3/4"	
XTIF-3658	3/16" on 5/8"	Fits: Ideal (special offset mounting)



Characters are mounted on CLEAR flat plastic tabs to fit a variety of letter holders.

Flat Surface Mounted Words (Flat Face)

description	example	cat#	cat#	cat#	cat#
single letter	3	XVFW-0136	XVFW-0114	XVFW-0112	XVFW-0101
2-3 letters	EXT	XVFW-2336	XVFW-2314	XVFW-2312	XVFW-2301
4-5 letters	25 MIN	XVFW-4536	XVFW-4514	XVFW-4512	XVFW-4501
6-7 letters	STRESS	XVFW-6736	XVFW-6714	XVFW-6712	XVFW-6701
8+ letters	PORTABLE	XVFW-8036	XVFW-8014	XVFW-8012	XVFW-8001
Lead/Plastic Sizes	3/16" on 3/4"	1/4" on 3/4"	1/2" on 3/4"	1" on 1 1/2"	



Words made from Mounted Letters glued to the surface of a single CLEAR vinyl strip.

Lead Letter Case

Cat.#XSLC-36

- Injection Molded Box.
- 36 scoop-bottom compartments (for A-Z and 0-9).
- Side compartment for holder.





NONDESTRUCTIVE TESTING EQUIPMENT

X-RAY FILM EXPOSURE HOLDERS



AQ Flexible

Vinyl impregnated flexible film holders. Ideal for bending around small objects such as piping and tanks. Provided in Blue unless Black is specified. Also available with lead backing, on request.



Semi-Rigid Black Vinyl

Outer cover made of 60 point abs black plastic. Has a tape hinge and a film envelope like the Flexible Film Holders. Ideal for heavy castings.



Rigid Red Vinyl

Rigid cardboard impregnated with red vinyl. Hinged on short side for easy handling of film. Also available with lead backing on request.

Stainless Steel

Die formed Stainless steel frame, hand welded for extra strength and durability. Heavy-duty tempered stainless steel crossbars that pivot on a rivet. Aluminum lined doors to absorb secondary radiation.



TYPE	AQ	SEMI-RIGID	RIGID RED	STAINLESS
SIZE	FLEXIBLE	BLACK VINYL	VINYL	STEEL
3 1/2" X 17"	REH-111	REH-311	REH-511	REH-411
4 1/2" X 10"	REH-112	REH-312	REH-512	REH-412
4 1/2" X 17"	REH-113	REH-313	REH-513	REH-413
5" X 7"	REH-114	REH-314	REH-514	REH-414
7" X 17"	REH-115	REH-315	REH-515	REH-415
8" X 10"	REH-116	REH-316	REH-516	REH-416
10" X 12"	REH-117	REH-317	REH-517	REH-417
11" X 14"	REH-118	REH-318	REH-518	REH-418
14" X 17"	REH-119	REH-319	REH-519	REH-419

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NONDESTRUCTIVE TESTING EQUIPMENT

LEAD INTENSIFYING SCREENS



HEXALON

High quality lead alloy foil mounted on cardboard. Available in both .005" and .010" in standard US industrial sizes of 3 1/2" x 17" thru 14" x 17". All corners are machine cut to a smooth 1/2" radius unless otherwise specified. Protective overlamine protects during shipping and storage. Remove before using.

PRIME

Production service screen with mirror finish. Ideal combination for quality and price. Uncoated lead off plastic. Prolongs life while preventing oxidation.



surface protected by peel-

SELECT

High quality screen ideal for high energy applications. Available in unbacked, Bristol board backed, 1/32" rubber or vinyl backed. Specify square or 1/2" rounded corners. Thicknesses up to .020" and .030".

TWEEN

Designed for applications requiring double loaded shots. This unique screen has .002" lead foil on each side of a thin cardboard. Intensifies the back film

SCREEN	HEXALON		PRIME		SELECT BRISTOL		SELECT	RUBBER	OR VINYL BACKED		TWEEN
TYPE	0.005"	0.010"	0.005"	0.010"	0.020"	0.030"	0.005"	0.010"	0.020"	0.030"	0.002"/0.002"
3 1/2" X 17"	RLS-581	RLS-181	RLS-531	RLS-131	RLS-251	RLS-351	RLS-571	RLS-171	RLS-271	RLS-381	RLS-441
4 1/2" X 10"	RLS-582	RLS-182	RLS-532	RLS-132	RLS-252	RLS-352	RLS-572	RLS-172	RLS-272	RLS-382	RLS-442
4 1/2" X 17"	RLS-583	RLS-183	RLS-533	RLS-133	RLS-253	RLS-353	RLS-573	RLS-173	RLS-273	RLS-383	RLS-443
5" X 7"	RLS-584	RLS-184	RLS-534	RLS-134	RLS-254	RLS-354	RLS-574	RLS-174	RLS-274	RLS-384	RLS-444
7" X 17"	RLS-585	RLS-185	RLS-535	RLS-135	RLS-255	RLS-355	RLS-575	RLS-175	RLS-275	RLS-385	RLS-445
8" X 10"	RLS-586	RLS-186	RLS-536	RLS-136	RLS-256	RLS-356	RLS-576	RLS-176	RLS-276	RLS-386	RLS-446
10" X 12"	RLS-587	RLS-187	RLS-537	RLS-137	RLS-257	RLS-357	RLS-577	RLS-177	RLS-277	RLS-387	RLS-447
11" X 14"	RLS-588	RLS-188	---	---	RLS-258	RLS-358	RLS-578	RLS-178	RLS-278	RLS-388	---
14" X 17"	RLS-589	RLS-189	RLS-539	RLS-139	RLS-259	RLS-359	RLS-579	RLS-179	RLS-279	RLS-389	RLS-449
70 MM X 180 FT	---	RLS-195	---	---	---	---	---	---	---	---	---
70 MM X 300 FT	RLS-595	---	---	---	---	---	---	---	---	---	---
3 1/2" X 180 FT	---	RLS-196	---	---	---	---	---	---	---	---	---
3 1/2" X 300 FT	RLS-596	---	---	---	---	---	---	---	---	---	---
4 1/2" X 180 FT	---	RLS-197	---	---	---	---	---	---	---	---	---
4 1/2" X 300 FT	RLS-597	---	RLS-593	---	---	---	---	---	---	---	---
17" X 54 FT	---	RLS-198	---	---	---	---	---	---	---	---	---
17" X 95 FT	RLS-598	---	---	---	---	---	---	---	---	---	---
70 MM X 150 FT	---	---	---	RLS-194	---	---	---	---	---	---	---
90 MM X 150 FT	---	---	---	RLS-199	---	---	---	---	---	---	---
90 MM X 300 FT	---	---	RLS-599	---	---	---	---	---	---	---	---
4 1/2" X 150 FT	---	---	---	RLS-191	---	---	---	---	---	---	---
17" X 50 FT	---	---	---	RLS-192	---	---	---	---	---	---	---
17" X 100 FT	---	---	RLS-592	---	---	---	---	---	---	---	---

Select screens up to 14" x 17" require crating - \$30. HexalON screens are \$10. per box (up to 50 per box). Specify square or rounded corners.

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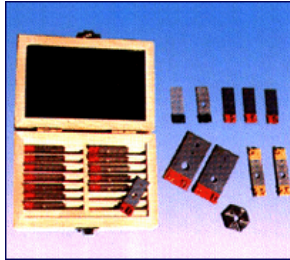


NONDESTRUCTIVE TESTING EQUIPMENT

PENETRAMETERS

(hole or plaque type)

Precision penetrameters are also referred to as IQI (Image Quality Indicators). Hole or Plaque type penetrameters are marked according to their specification. Each penetrameter exceeds or conforms to requirements of each code or Mil Standard. Lead figures identifying the penetrameter size and in the case of some MIL Specs, the material, are affixed to the penetrameter. Penetrameter material is also identified by a unique color code. Each penetrameter is chemically etched, identifying the material and specification. Sharp, smooth edges with accurate, perfectly spaced, drilled and reamed holes, give the radiographer every advantage in obtaining clear, well defined images on the radiograph.



Some specifications use a number which represents 2% of the thickness of the material to be x-rayed (and the actual thickness of the penetrameter). Other specifications mark the penetrameter according to the thickness of material to be x-rayed.

Material Thickness to be x-rayed	.50"	.75"	1.0"	1.25"	1.50"	2.00"
Actual Penny Thickness	0.010"	0.015"	0.020"	0.025"	0.030"	0.040"
ASME, ASTM E-1025, API, AWS	#10	#15	#20	#25	#30	#40
NAVSEA 271, ASTM E-1742, NAVSHIPS	.50	.75	1	1.2	1.5	2

Penetrameters are priced by material and thickness. Select the material and thickness range from the chart below to determine part number. Specify Part number, Specification and actual penetrameter number or thickness desired (i.e. – RPN-311 ASME. Stainless, 10 ea - #25, and 15 ea - #30). All penetrameters are accompanied by a Certificate of Conformance to the specification. Serialization and encapsulation are available upon request at a nominal additional charge.

SIZE	0.06" - 1.0"	1.2" - 2.5"	2.6" - 5.0"	5.2" - 8.0"	8.2" - 20.0"	SET A (25)	SET B (11)
MATERIAL	#5 - #20	#25 - #50	#52 - #100	#110 - #160	#170 - #400	#5 - #50	#55 - #160
INCONEL	RPN-010	RPN-011	RPN-021	RPN-025	RPN-030	RPN-040	RPN-050
ALUMINUM	RPN-110	RPN-111	RPN-121	RPN-125	RPN-130	RPN-140	RPN-150
STEEL	RPN-210	RPN-211	RPN-221	RPN-225	RPN-230	RPN-240	RPN-250
STAINLESS	RPN-310	RPN-311	RPN-321	RPN-325	RPN-330	RPN-340	RPN-350
MAGNESIUM	RPN-410	RPN-411	RPN-411	RPN-415	RPN-430	RPN-440	RPN-450
BRASS	RPN-510	RPN-511	RPN-521	RPN-525	RPN-530	RPN-540	RPN-550
COPPER	RPN-610	RPN-611	RPN-621	RPN-625	RPN-630	RPN-640	RPN-650
CuNi	RPN-710	RPN-711	RPN-721	RPN-725	RPN-730	RPN-740	RPN-750
TITANIUM	RPN-810	RPN-811	RPN-821	RPN-825	RPN-830	RPN-840	RPN-850
MONEL	RPN-910	RPN-911	RPN-921	RPN-925	RPN-930	RPN-940	RPN-950

Applicable codes

API 1650

API 1104

NAVSHIPS 250-1500

ASTM E 1742 (replaces MIL-STD 453C)

T9074-AS-GIB-010/271 (replaces MIL-STD 271F)

ASME Sec V

ASTM E 142-72

ASTM E 1025

AWS D2.0 – 71

AWS D10.9- 71

MIL-R-11471

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DETEK, INC

RADIOGRAPHIC PRODUCTS

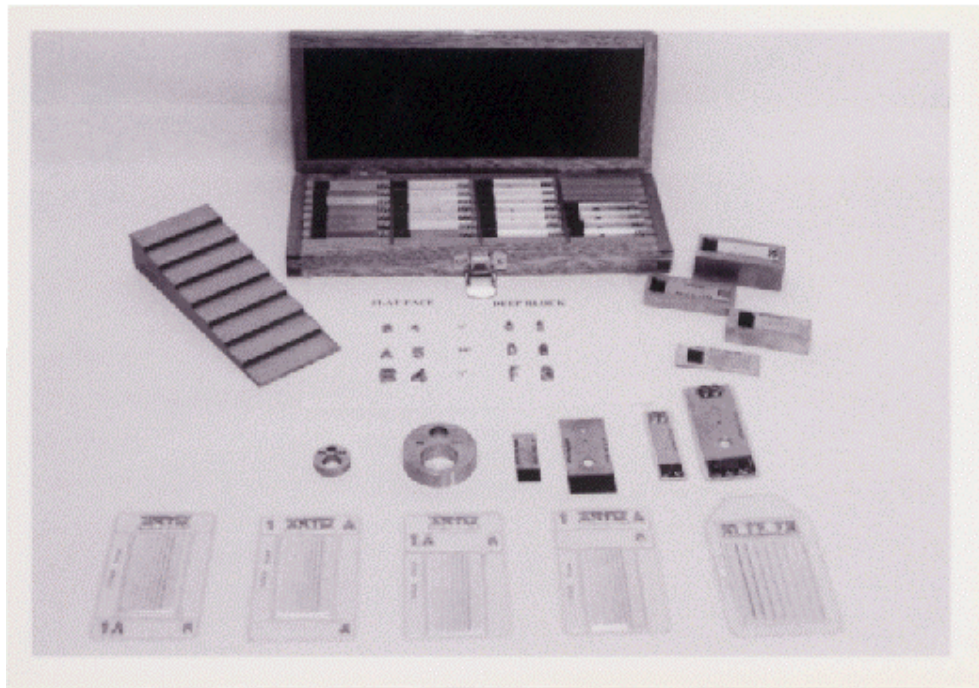


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IMAGE QUALITY INDICATORS

DETEK, Inc provides precision I.Q.I.s that rigidly conform to and exceed requirements of each code and MIL-spec. Lead figures identifying the penetrometer size and in the case of some MIL specs, the material, are affixed to the penetrometer. Each penetrometer is chemically etched identifying the material and specification.

Sharp, smooth edges with accurate, perfectly spaced drilled and reamed holes, ultrasonically cleaned, give the technician every advantage in obtaining clear, well defined images on the radiograph. Copies of material certifications are available on request. All penetrameters are accompanied by a certificate of conformity. The quality control system complies with ISO 9002 (replaces MIL-I-45208A) and ANSI-NCSL-Z540 (replaces MIL-STD-45662-A) and is traceable to the National Institute of Standards and Technology (NIST).

SPECIAL CALIBRATION

I.Q.I.s may be serialized and calibrated resolving to the 4th decimal, for a nominal charge.

I.Q.I. ENCAPSULATION

Penetrameters may be encapsulated in clear, thin walled plastic if requested. This leaves I.Q.I.s hermetically sealed by vacuum heat sealing. Cost is nominal.

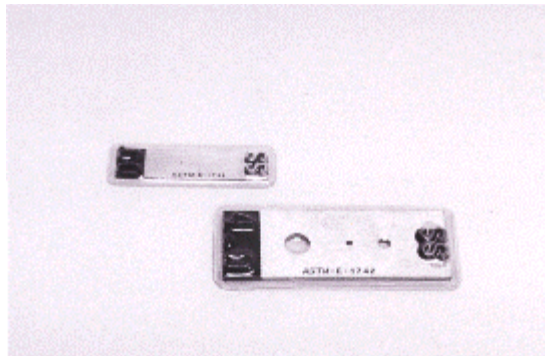


IMAGE QUALITY INDICATORS

STOCK I.Q.I.s

Stock penetrameters (IQIs) are available for prompt shipment. Stock penetrameters are standard sizes within each code and of the material listed below.

STOCK I.Q.I.s CODES AND MIL-SPECS

ASME (ALL CODES)	ASTM-E 1025 (Plaque type)
T9074-AS-GIB-010/271 (Formerly MIL-STD-271F)	ASTM-E-747 (Wire type)
MIL-R-11471	EN462-1(European wire type) (Formerly DIN)
API (ALL CODES)	AWS
ASTM-E-1742 (Formerly MIL-STD-453)	AWWA
NAVSEA 250-1500-1	PRATT & WHITNEY TAMs
	PRATT & WHITNEY AMS 2635 C

STOCK I.Q.I. MATERIALS

ALUMINUM (6061)	ALUMINUM- BRONZE
BRASS	COPPER
CUPRO-NICKEL (70-30)	INCONEL 600
MAGNESIUM (AZ-31)	MONEL 400
STEEL (1018)	STAINLESS STEEL (304)
TITANIUM (CP & 6-4)	ZIRCONIUM
HAYNES 25 (COBALT)	COMPOSITES (Graphite , Silica, etc.)
HASTELLOYS (B, C, X)	

I.Q.I SIZES

In accordance with MIL-specs, the size of the penetrameter is identified by two (2) lead numbers cemented to the penetrameter. These lead numbers represent the two (2) significant digits of the decimal equivalent of the maximum thickness of section to be radiographed. In the case API, ASME, ASTM, and AWS codes, these are identified by a number representing the thickness of the penetrameter itself. Thus a penetrameter with a thickness of .005" is identified as a #5.

INCREMENTS

Penetrameters are manufactured in the following increments:

1/16" thru 1".....	1/16"
1" thru 2 1/2".....	1/8"
2 1/2" and larger.....	1/4"

COLOR CODE

Penetrameter materials are indicated by color code:

Stainless Steel.....	Red
Steel.....	Orange
Aluminum.....	Blue
Magnesium.....	Yellow
Nickel, and Nickel based alloys..... (Inconel, Hastelloy, Monel, etc.)	Green
Copper, Cupro-Nickel.....	Copper
Brasses, and Bronzes.....	Silver
Cobalt, Titanium, Zirconium, Niobium(Columbium)	Brown

SPECIAL I.Q.I.s

Special penetrameters are regularly manufactured to customers specifications. Quotations will be made when drawings or specifications are received. Delivery of special penetrameters is usually within ten (10) days of the order.

ADDITIONAL MATERIALS & SPECIFICATIONS

I.Q.Is conforming to specifications or of materials not included in the lists of stock items on page one are made to order as required. Penetrators of nearly any known material and to any U.S. specification can quickly be manufactured in our shops.

I.Q.Is can be readily manufactured from the following materials:

NIOBIUM (COLUMBIUM)	HAFNIUM
HERCULOY	LEAD (PURE)
MAG-THORIUM	MOLYBDENUM
NICKEL ALLOYS	PHOSPHOR-BRONZE (VALVE BRONZE)
RENE 41	SILVER
TANTALUM	STEEL (MARAGING)
BERYLLIUM COPPER	ZIRCALOY (2, and 4)
WASPALOY	ALL COMPOSITES
HAYNES COBALT ALLOYS	

In addition to those materials listed above, I.Q.Is of unusual materials can be manufactured from materials, both metals and non-metals, of which some stock is maintained. However, when I.Q.Is are to be of very unusual material it is usually more advantageous to the customer to supply such material.

Most specifications do not require I.Q.Is to be of the identical alloy as that of the object being radiographed. It is usually only necessary that they be of the same material, having approximately the same density and radiation absorption.

MATERIALS IDENTIFICATION

Most codes and specifications require that penetrimeters, of all materials, shall have suitable permanent identification marks so as to be distinguished with respect to materials. In some cases (such as ASTM-E-1742; NAVSEA) it is also required that the penetrimeter be identified as to the predominant constituent of the penetrimeter, by utilizing the chemical symbol. In the case of ASTM E 1742, the material is to be identified by two lead letters permanently affixed to the penetrimeter.

CHEMICAL SYMBOLS USED FOR MATERIAL IDENTIFICATION

STOCK MATERIALS

AB:	ALUMINUM BRONZE	AL:	ALUMINUM
BR:	BRASS	CU:	COPPER
CU:	CUPRO - NICKEL	CU:	PHOSPHOR BRONZE
FE:	STEEL	IN:	INCONEL
MG:	MAGNESIUM	NI:	NICKEL
NI:	HASTELLOYS (B, C, X)	NI:	MONEL
SS:	STAINLESS STEEL	TI:	TITANIUM

SPECIAL & EXOTIC MATERIALS

AG:	SILVER	BE:	BERYLLIUM
CB:	COLUMBIUM (NIOBIUM)	CU:	BERYLLIUM - COPPER
HE:	HERCULOY	HF:	HAFNIUM
MO:	MOLYBDENUM	MT:	MAGNESIUM - THORIUM
NI:	RENE 41	NI:	WASPALOY
PB:	LEAD	TA:	TANTALUM
ZR:	ZIRCONIUM	ZR:	ZIRCALOY

In order to expedite shipment and minimize delay of any order, the following must be furnished at the time the order is received:

Code or Spec.,
Material,
Size,
Quantity

PENETRAMETERS IN SETS

ASTM-E-1742

(Formerly MIL- STD 453)

Two standard penetrameter sets are available from stock.

Set “A” consists of twenty-five I.Q.I.s and contains the following sizes:

**.25, .31, .37, .43, .50, .56, .62, .68, .75, .81, .87, .93,
1.0, 1.1, 1.2, 1.3, 1.5, 1.6, 1.7, 1.8, 2.0, 2.1, 2.2, 2.3, 2.5**

Set “B” consists of eleven I.Q.I.s and contains the following sizes:

2.7, 3.0, 3.2, 3.5, 3.7, 4.0, 4.5, 5.0, 6.0, 7.0, 8.0

ASTM & ASME

Two standard penetrameter sets are available from stock.

Set “A” consists of twenty-five I.Q.I.s and contains the following sizes:

**#5, #6, #7, #9, #10, #11, #12, #13, #15, #16, #17, #18, #20,
#22, #25, #27, #30, #32, #35, #37, #40, #42, #45, #47, #50**

Set “B” consists of eleven I.Q.I.s and contains the following sizes:

#55, #60, #65, #70, #75, #80, #90, #100, #120, #140, #160

NAVSEA T9074-AS-GIB-010/271

(formerly MIL-STD-271 F),

NAVSHIPS 250-1500-1

Two standard penetrameter sets are available from stock.

Set “A” consists of twenty-eight I.Q.I.s and contains the following sizes:

**.25, .30, .35, .40, .45, .50, .55, .60, .65, .70, .75, .80, .85, .90, .95
1.0, 1.1, 1.2, 1.3, 1.5, 1.6, 1.7, 1.8, 2.0, 2.1, 2.2, 2.3, 2.5,**

Set “B” consists of eleven I.Q.I.s and contains the following sizes:

2.7, 3.0, 3.2, 3.5, 3.7, 4.0, 4.5, 5.0, 6.0, 7.0, 8.0

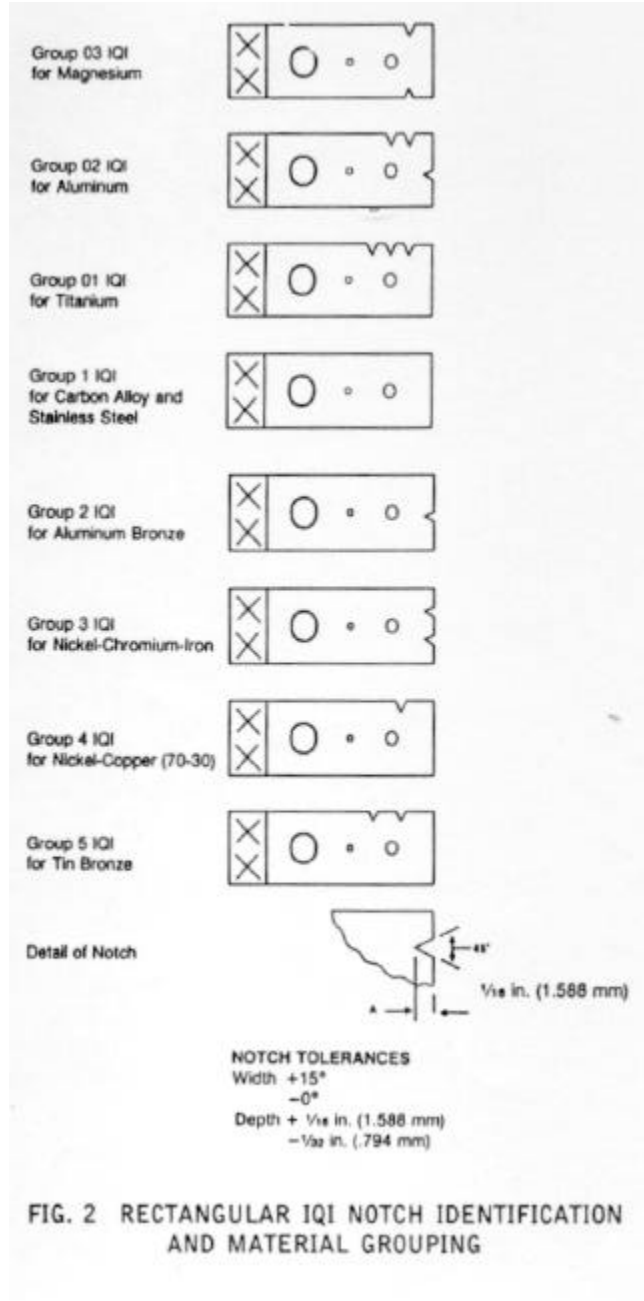
PENETRAMETER CASES

Penetrameter cases are available for the penetrameters you now have, and are engineered to prevent loss and damage. They are handsomely styled, and constructed of solid Philippine mahogany with a hand-rubbed finish. Each case is provided with shock absorbing sponge rubber in the lid to keep penetrameters firmly in place.



NOTCHING SYSTEM:

This notching system applies to ASME SE 1025; ASTM-E-1025; NAVSEA T9074 -AS-GIB-010/271; and NAVSEA 250-1500-1 specs.



ASME SEC.V SE 1025

All ASME sections reference ASME Sec. V SE 1025 (identical to ASTM-E-1025).

IDENTIFICATION:

A notching system for eight grades of penetrameters is used for identification of rectangular penetrameters on the radiograph. These grades are grouped according to their increasing attenuation. The thickness of the penetrameter is identified by lead numbers. The penetrameters are further identified by electro-chemically etching the material, and spec.

I.Q.I. SELECTION:

Penetrameter selection for use in accordance with ASME Sec V. is determined using table T-276 in article 2, shown below.

Nominal Single-Wall Material Thickness Range, in.	IQI			
	Source Side		Film Side	
	Hole-Type Designation	Wire-Type Essential Wire	Hole-Type Designation	Wire-Type Essential Wire
Up to 0.25, incl.	12	5	10	4
Over 0.25 through 0.375	15	6	12	5
Over 0.375 through 0.50	17	7	15	6
Over 0.50 through 0.75	20	8	17	7
Over 0.75 through 1.00	25	9	20	8
Over 1.00 through 1.50	30	10	25	9
Over 1.50 through 2.00	35	11	30	10
Over 2.00 through 2.50	40	12	35	11
Over 2.50 through 4.00	50	13	40	12
Over 4.00 through 6.00	60	14	50	13
Over 6.00 through 8.00	80	16	60	14
Over 8.00 through 10.00	100	17	80	16
Over 10.00 through 12.00	120	18	100	17
Over 12.00 through 16.00	160	20	120	18
Over 16.00 through 20.00	200	21	160	20

See TABLE 1 "WIRE IQI SIZES AND WIRE IDENTITY NUMBERS" on page 20 to select wire IQI as determined by essential wire required.

ASTM-E-1025



IDENTIFICATION:

A notching system for eight grades of penetrators is used for identification of rectangular penetrators on the radiograph. These grades are grouped according to their increasing attenuation. The thickness of the penetrator is identified by lead numbers. The penetrators are further identified by electro-chemically etching the material, and spec.

GENERAL DIMENSIONS:

SIZE	LENGTH	WIDTH
#50 & smaller	1 1/2"	1/2"
over #50 to #160 incl.	2 1/4"	1"
Over #160	Diameter is equal to 4 x thickness	
	(Number of holes: 2)	

THICKNESS:

Penetrator thickness is determined by image quality level required using the table below. The industry standard is 2% of the thickness to be radiographed, to the nearest fractional size.
Minimum thickness: .005"

Standard Image Quality Levels			
Image Quality Levels	IQI Thickness	Minimum Preceptible Hole Diameter	Equivalent IQI Sensitivity, % ^B
2-1T	$\frac{1}{50}$ (2%) of Specimen Thickness	1T	1.4
2-2T ^A		2T	2.0
2-4T		4T	2.8
Special Image Quality Levels			
1-1T	$\frac{1}{100}$ (1%) of Specimen Thickness	1T	0.7
1-2T		2T	1
4-2T	$\frac{1}{25}$ (4%) of Specimen Thickness	2T	4

^AFor Level 2-2T Radiologic — The 2T hole in an IQI, $\frac{1}{50}$ (2%) of the specimen thickness, is visible.
^BEquivalent IQI sensitivity is that thickness of the IQI, expressed as a percentage of the part thickness, in which the 2T hole would be visible under the same conditions.

HOLE SIZES:

Small hole dia.:	1 X THICKNESS	(min: .010")
Medium hole dia.:	2 X THICKNESS	(min: .020")
Large hole dia.:	4 X THICKNESS	(min: .040")

ASTM-E-1742

(FORMERLY MIL-STD-453)



IDENTIFICATION:

Lead figures identify the thickness of the material to be radiographed on one end, and the material of the penetrameter on the other end.

GENERAL DIMENSIONS:

SIZE	LENGTH	WIDTH
2.5" & smaller	2"	1/2"
2.6" to 8"	2.850"	1"
Over 8"	Diameter equal to 4 X Thickness (Number of holes: 2)	

THICKNESS:

2 % of the thickness of the material to be radiographed, to the nearest fractional size.
Minimum thickness: .005"

HOLE SIZES:

Small hole dia.	1 X THICKNESS	(min: .010")
Medium hole dia.	2 X THICKNESS	(min: .020")
Large hole dia.	4 X THICKNESS	(min: .040")

NAVSEA T9074-AS-GIB-010/271

FORMERLY MIL-STD-271 F



IDENTIFICATION:

A notching system for eight grades of penetrameters is used for identification of rectangular penetrameters on the radiograph. These grades are grouped according to their increasing attenuation. Lead figures identify the thickness of the material to be radiographed. The penetrameter is further identified by electro-chemically etching the material and the spec.

GENERAL DIMENSIONS:

SIZE	LENGTH	WIDTH
2.5" & smaller	1 1/2"	1/2"
2.6" to 8"	2 1/4"	1"
Over 8"	Diameter equal to 4 X Thickness (Number of holes: 2)	

THICKNESS:

2 % of the thickness of the material to be radiographed, to the nearest fractional size.
Minimum thickness: .005"

HOLE SIZES:

Small hole dia.	1 X THICKNESS	(min: .010")
Medium hole dia.	2 X THICKNESS	(min: .020")
Large hole dia.	4 X THICKNESS	(min: .040")

NAVSEA 250-1500-1



IDENTIFICATION:

A notching system as listed below is used for identification of rectangular penetrators on the radiograph. These grades correspond with the notching system listed before and are grouped according to their increasing attenuation. Lead figures identify the thickness of the material to be radiographed. The penetrator is further identified by electro-chemically etching the material and the spec.

NOTCHING SYSTEM:

GROUP I	Steel, Stainless steel, Manganese	No notches
GROUP II	Aluminum-Bronze; Nickel-Aluminum-Bronze	1 notch on end
GROUP III	Inconel	2 notches on end
GROUP IV	Nickel, Copper, Monel, Cupro-Nickel	1 notch on top edge
GROUP V	Tin Bronze, Valve Bronze	2 notches on top edge

GENERAL DIMENSIONS:

SIZE	LENGTH	WIDTH
2.5" & smaller	1 1/2"	1/2"
2.6" to 8"	2 1/4"	1"
Over 8"	Diameter equal to 4 X Thickness (Number of holes: 2)	

THICKNESS:

2 % of the thickness of the material to be radiographed, to the nearest fractional size.
Minimum thickness: .005"

HOLE SIZES:

Small hole dia.	1 X THICKNESS	(min: .010")
Medium hole dia.	2 X THICKNESS	(min: .020")
Large hole dia.	4 X THICKNESS	(min: .040")

U. S. ARMY ORDNANCE
MIL-R-11471-3

GENERAL DIMENSIONS:

SIZE	LENGTH	WIDTH
2.5" & smaller	1 1/2"	1/2"
2.6" to 8"	2 1/4"	1"
Over 8"	Diameter equal to 4 X Thickness (Number of holes: 2)	

THICKNESS:

2 % of the thickness of the material to be radiographed, to the nearest fractional size.
Minimum thickness: .005"

HOLE SIZES:

Small hole dia.	1 X THICKNESS	(min: .010")
Medium hole dia .	2 X THICKNESS	(min: .020")
Large hole dia.	4 X THICKNESS	(min: .040")

API 1104 PIPELINE

API 1104 specifies the use of penetrameters conforming to requirements of either ASTM-E-142* , or “figure 20” for hole type penetrameters, or ASTM-E-747 for wire type penetrameters. Penetrometer selection is determined by the set of requirements to be used as shown in tables 5, 6, & 7.

*ASTM-E-1025 supercedes ASTM-E-142 for penetrometer design.

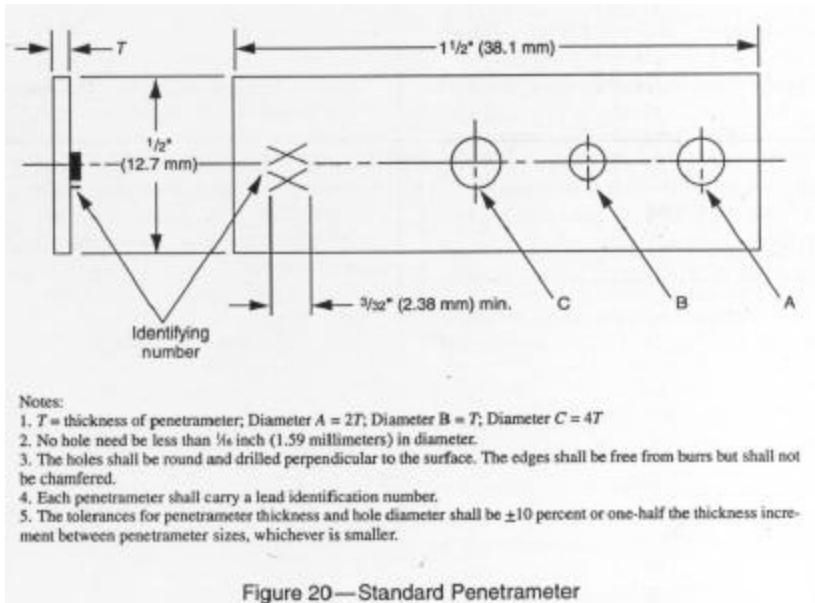
GENERAL DIMENSIONS:

SIZE	LENGTH	WIDTH
#50 & smaller	1 1/2"	1/2"
Over #50 to #160	2 1/4"	1"
Over #160	Diameter equal to 4 X Thickness	(Number of holes: 2)

Table 6—Thickness of Pipe Versus Thickness of Penetrometer*

Pipe Wall or Weld Thickness		Maximum Penetrometer Thickness		Identifying Number
Inches	Millimeters	Inches	Millimeters	
0–¼	0–6.35	0.005	0.127	5
>¼–⅜	>6.35–9.52	0.0075	0.19	7
>⅜–½	>9.52–12.70	0.010	0.254	10
>½–¾	>12.70–15.88	0.0125	0.317	12
>¾–1	>15.88–19.05	0.015	0.381	15
>1–1¼	>19.05–22.22	0.0175	0.444	17
>1¼–1½	>22.22–25.40	0.020	0.508	20
>1½–1¾	>25.40–31.75	0.025	0.635	25
>1¾–2	>31.75–38.10	0.030	0.762	30
		0.035	0.889	35

* See Figure 20.



API 1104 PIPE LINE

CONTINUED

Table 5—Thickness of Pipe Versus Thickness of ASTM E 142 Penetrameter

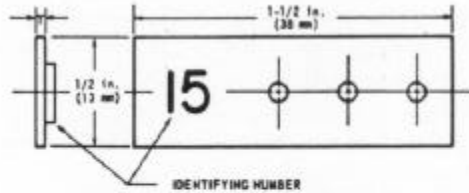
Pipe Wall or Weld Thickness		Maximum Penetrameter Thickness		Identifying Number
Inches	Millimeters	Inches	Millimeters	
0–¼	0–6.35	0.0125	0.317	12
>¼–¾	>6.35–9.52	0.015	0.381	15
>¾–½	>9.52–12.70	0.0175	0.444	17
>½–¾	>12.70–19.05	0.020	0.508	20
>¾–1	>19.05–25.40	0.025	0.635	25
>1–2	>25.40–50.80	0.030	0.762	30

Table 7—Thickness of Pipe Versus Diameter of ASTM E 747 Wire Penetrameter

Weld Thickness		Essential Weld Diameter		ASTM Set Letter
Inches	Millimeters	Inches	Millimeters	
0–¼	0–6.35	0.008	0.20	A
>¼–¾	>6.35–9.52	0.010	0.25	A or B
>¾–½	>9.52–12.70	0.013	0.33	B
>½–¾	>12.70–19.05	0.016	0.41	B
>¾–1	>19.05–25.40	0.020	0.51	B
>1–2	>25.40–50.80	0.025	0.64	B

API 5L

API 5L specifies the use of penetrameters conforming to “figure 6” as shown below. Penetrameter selection is determined by the set of requirements to be used as shown in tables 14, & 15.



Notes:

1. The diameter of each hole shall be $\frac{1}{16}$ in. (1.6 mm).
2. Holes shall be round and drilled perpendicular to the surface.
3. Holes shall be free of burrs, but edges shall not be chamfered.
4. Each penetrameter shall carry a lead identification number as given in Tables 14 and 15.

Figure 6—API Standard Penetrameter

Table 14—API Standard 4 Percent Penetrameters

(1)		(2)		(3)		(4)
Wall Thickness				Maximum Penetrameter Thickness		Identifying Number
Over		Through		Thickness		
in.	mm	in.	mm	in.	mm	
$\frac{3}{16}$ or 0.188	(4.8)	$\frac{1}{4}$ or 0.250	(6.4)	0.010	(0.25)	10
$\frac{1}{4}$ or 0.250	(6.4)	$\frac{3}{16}$ or 0.313	(7.9)	0.0125	(0.32)	12
$\frac{5}{16}$ or 0.313	(7.9)	$\frac{3}{8}$ or 0.375	(9.5)	0.015	(0.38)	15
$\frac{3}{8}$ or 0.375	(9.5)	$\frac{7}{16}$ or 0.438	(11.1)	0.0175	(0.45)	17
$\frac{7}{16}$ or 0.438	(11.1)	$\frac{1}{2}$ or 0.500	(12.7)	0.020	(0.51)	20
$\frac{1}{2}$ or 0.500	(12.7)	$\frac{5}{8}$ or 0.625	(15.9)	0.025	(0.64)	25
$\frac{5}{8}$ or 0.625	(15.9)	$\frac{3}{4}$ or 0.750	(19.1)	0.030	(0.76)	30
$\frac{3}{4}$ or 0.750	(19.1)	1 or 1.000	(25.4)	0.040	(1.02)	40
1 or 1.000	(25.4)	$1\frac{1}{4}$ or 1.250	(31.8)	0.050	(1.27)	50
$1\frac{1}{4}$ or 1.250	(31.8)	$1\frac{1}{2}$ or 1.500	(38.1)	0.060	(1.52)	60

Table 15—API Standard 2 Percent Penetrameters

(1)		(2)		(3)		(4)
Wall Thickness				Maximum Penetrameter Thickness		Identifying Number
Over		Through		Thickness		
in.	mm	in.	mm	in.	mm	
$\frac{7}{32}$ or 0.219	(5.1)	$\frac{1}{4}$ or 0.250	(6.4)	0.005	(0.13)	5
$\frac{1}{4}$ or 0.250	(6.4)	$\frac{3}{16}$ or 0.313	(7.9)	0.006	(0.15)	6
$\frac{3}{16}$ or 0.313	(7.9)	$\frac{3}{8}$ or 0.375	(9.5)	0.0075	(0.19)	7
$\frac{3}{8}$ or 0.375	(9.5)	$\frac{1}{2}$ or 0.500	(12.7)	0.010	(0.25)	10
$\frac{1}{2}$ or 0.500	(12.7)	$\frac{5}{8}$ or 0.625	(15.9)	0.0125	(0.32)	12
$\frac{3}{8}$ or 0.625	(15.9)	$\frac{3}{4}$ or 0.750	(19.1)	0.015	(0.38)	15
$\frac{3}{4}$ or 0.750	(19.1)	$\frac{7}{8}$ or 0.875	(22.2)	0.0175	(0.45)	17
$\frac{7}{8}$ or 0.875	(22.2)	1 or 1.000	(25.4)	0.020	(0.51)	20
1 or 1.000	(25.4)	$1\frac{1}{4}$ or 1.250	(31.8)	0.025	(0.64)	25
$1\frac{1}{4}$ or 1.250	(31.8)	$1\frac{1}{2}$ or 1.500	(38.1)	0.030	(0.76)	30

API 5L

CONTINUED

WIRE IQIs (EN TYPE)

Wire type IQI selection is determined by the requirements of tables 16, & 17.

Table 16—ISO Wire 4 Percent Penetrators

(1) Wire Number	(2) Wall Thickness				(4) Wire Diameter	
	Over		Through		in.	mm
	in.	mm	in.	mm		
$Fe^{1/7}$						
1	2.50	(63.5)	3.25	(82.6)	.13	(3.20)
2	2.00	(50.8)	2.50	(63.5)	.10	(2.50)
3	1.62	(41.1)	2.00	(50.8)	.08	(2.00)
4	1.25	(31.8)	1.62	(41.1)	.065	(1.60)
5	1.00	(25.4)	1.25	(31.8)	.050	(1.25)
6	0.80	(20.3)	1.00	(25.4)	.040	(1.00)
7	0.63	(15.9)	0.80	(20.3)	.032	(0.80)
$Fe^{6/12}$						
6	0.800	(20.3)	1.000	(25.4)	.040	(1.00)
7	0.625	(15.9)	0.800	(20.3)	.032	(0.80)
8	0.500	(12.7)	0.625	(15.9)	.025	(0.63)
9	0.400	(10.2)	0.500	(12.7)	.020	(0.50)
10	0.325	(8.3)	0.400	(10.2)	.016	(0.40)
11	0.250	(6.4)*	0.325	(8.3)	.013	(0.32)
12	0.200	(5.1)	0.250	(6.4)	.010	(0.25)
$Fe^{10/16}$						
10	0.325	(8.3)	0.400	(10.2)	.016	(0.40)
11	0.250	(6.4)	0.325	(8.3)	.013	(0.32)
12	0.200	(5.1)	0.250	(6.4)	.010	(0.25)
13	0.162	(4.1)	0.200	(5.1)	.008	(0.20)
14	0.125	(3.2)	0.162	(4.1)	.006	(0.16)
15	0.100	(2.5)	0.125	(3.2)	.005	(0.13)
16	0.080	(2.0)	0.100	(2.5)	.004	(0.10)

Table 17—ISO Wire 2 Percent Penetrators

(1) Wire Number	(2) Wall Thickness				(4) Wire Diameter	
	Over		Through		in.	mm
	in.	mm	in.	mm		
$Fe^{1/7}$						
1	5.00	(127.0)	6.50	(165.2)	.13	(3.20)
2	4.00	(101.6)	5.00	(127.0)	.10	(2.50)
3	3.25	(82.6)	4.00	(101.6)	.08	(2.00)
4	2.50	(63.5)	3.25	(82.6)	.065	(1.60)
5	2.00	(50.8)	2.50	(63.5)	.050	(1.25)
6	1.60	(40.6)	2.00	(50.8)	.040	(1.00)
7	1.25	(31.8)	1.60	(40.6)	.032	(0.80)
$Fe^{6/12}$						
6	1.600	(40.6)	2.00	(50.8)	.040	(1.00)
7	1.250	(31.8)	1.60	(40.6)	.032	(0.80)
8	1.000	(25.4)	1.250	(31.8)	.025	(0.63)
9	0.800	(20.3)	1.000	(25.4)	.020	(0.50)
10	0.650	(16.5)	0.800	(20.3)	.016	(0.40)
11	0.500	(12.7)	0.650	(16.5)	.013	(0.32)
12	0.400	(10.1)	0.500	(12.7)	.010	(0.25)
$Fe^{10/16}$						
10	0.625	(16.2)	0.800	(20.3)	.016	(0.40)
11	0.500	(12.7)	0.650	(16.2)	.013	(0.32)
12	0.400	(10.1)	0.500	(12.7)	.010	(0.25)
13	0.325	(8.3)	0.400	(10.1)	.008	(0.20)
14	0.250	(6.4)	0.325	(8.3)	.006	(0.16)
15	0.200	(5.1)	0.250	(6.4)	.005	(0.13)
16	0.160	(4.1)	0.200	(5.1)	.004	(0.10)

API 650

AWS D1.1-96

AWWA D100-96

API 650 (TENTH EDITION: NOVEMBER 1998); AWS D1.1-96; AWWA D100-96 specify that the radiographic method employed shall be in accordance with ASME sec. V, article 2

ASTM-E-801

SEMI-CONDUCTOR IQIs

USE:

Controlling quality of radiological examination of electronic devices.

SCOPE:

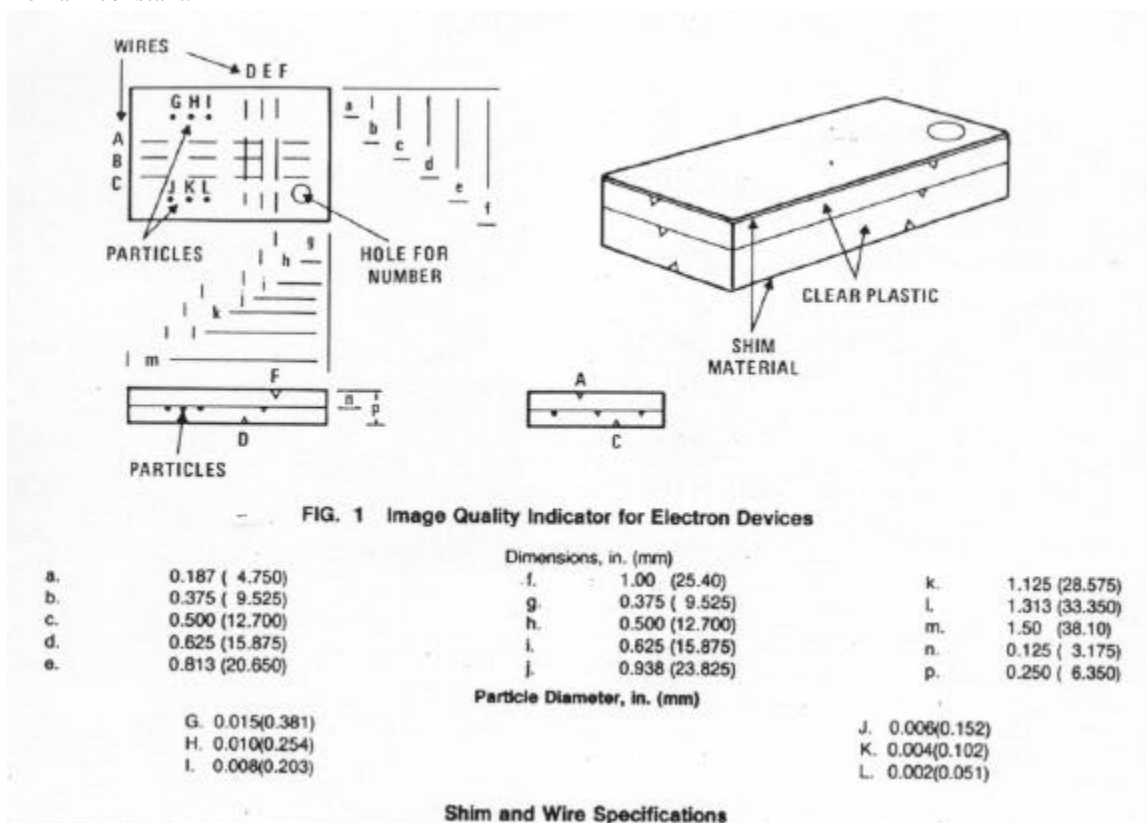
ASTM-E-801 relates to the radiological examination of electronic devices for internal discontinuities, extraneous material, missing components, crimped or broken wires, and defective solder joints, in cavities in the encapsulating materials, or the boards.

IQIs:

IQIs shall be fabricated of clear acrylic plastic with steel covers, lead spheres gold or tungsten wires, and lead numbers. They shall be accompanied by calibration sheets listing actual physical wire placements.

APPLICATION:

The function of this type of IQI is to simulate as closely as possible the device being examined. A set of eight IQIs having a range of wire diameters and cover thicknesses (steel shim stock) provide for a range of radiological equivalences to the range of devices from glass diodes or plastic-encapsulated circuits (number one) to large power or hybrid circuit devices (number eight). Wire size increases with shim stock thickness because the higher power devices, which are radiologically compatible with the thicker coverings, normally use larger interconnecting wires than small signal devices which use the thin coverings. Particle size is normally independent of device type, so these remain constant.



WIRE TYPE IQIs

ASTM E 747 - 97

Accepted by ASME V and AWS as an alternative to plaque type IQIs. These penetrameters are encapsulated in vinyl for durability. Available in 4 sizes (Sets A, B, C, and D) in Aluminum, Copper, and Stainless Steel. Also available in Sets A and B are Inconel and Titanium.

ASTM-E-747 wire type IQIs are manufactured with 6 wires in each size, as shown in the table below.

SET A		SET B	
Wire Diameter in. (mm)	Wire Identity	Wire Diameter in. (mm)	Wire Identity
0.0032 (0.08) ^A	1	0.010 (0.25)	6
0.004 (0.1)	2	0.013 (0.33)	7
0.005 (0.13)	3	0.016 (0.4)	8
0.0063 (0.16)	4	0.020 (0.51)	9
0.008 (0.2)	5	0.025 (0.64)	10
0.010 (0.25)	6	0.032 (0.81)	11
SET C		SET D	
Wire Diameter in. (mm)	Wire Identity	Wire Diameter in. (mm)	Wire Identity
0.032 (0.81)	11	0.10 (2.5)	16
0.040 (1.02)	12	0.126 (3.2)	17
0.050 (1.27)	13	0.160 (4.06)	18
0.063 (1.6)	14	0.20 (5.1)	19
0.080 (2.03)	15	0.25 (6.4)	20
0.100 (2.5)	16	0.32 (8)	21

^A The 0.0032 wire may be used to establish a special quality level as agreed upon between the purchaser and the supplier.

Each size IQI covers a range of thicknesses for which it is used, based on a standard 2T level of inspection.

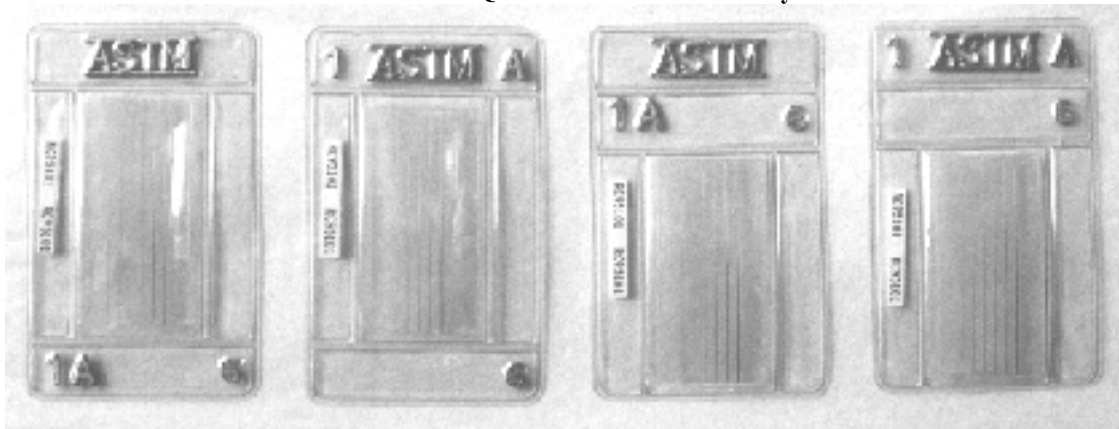
IQI SIZE

- SET A
- SET B
- SET C
- SET D

THICKNESS RANGE

- .25 THRU .75 IN.
- .75 THRU 1.7 IN.
- 1.7 THRU 4.0 IN.
- 4.0 THRU 10.0 IN

ASTM-E-747 IQIs are available in four styles as shown



STYLE 1

STYLE 1.1

STYLE 2

STYLE 3

STYLE 1 and STYLE 2 carry the same designation as “Alternate 1” and “Alternate 2” respectively as shown in the ASTM Book of Standards

EN 462-1 WIRE TYPE IQIs

FORMERLY DIN 54.109

Published by European committee for standardization; EN-462-1 replaces DIN 54.109.

Based on a series of wire diameters, subdivided into ranges of 7 wires. The lead symbol identifies the largest wire, material and "EN" specification.

EN 462-1 IQIs are available in STEEL, ALUMINUM, and COPPER in sizes 1 EN, 6EN, 10 EN, and 13 EN, and TITANIUM in sizes 6 EN and 10 EN.

1 EN			6EN		
WIRE #	WIRE DIAM. mm	WIRE DIAM in.	WIRE #	WIRE DIAM. mm	WIRE DIAM in.
1	3.20	.1259	6	1.00	.0393
2	2.50	.0984	7	0.80	.0315
3	2.00	.0787	8	0.63	.0248
4	1.60	.0629	9	0.50	.0196
5	1.25	.0492	10	0.40	.0157
6	1.00	.0393	11	0.32	.0126
7	0.80	.0315	12	0.25	.0098

10 EN			13 EN		
WIRE #	WIRE DIAM. mm	WIRE DIAM in.	WIRE #	WIRE DIAM. mm	WIRE DIAM in.
10	0.40	.0157	13	0.20	.0078
11	0.32	.0126	14	0.16	.0063
12	0.25	.0098	15	0.13	.0049
13	0.20	.0078	16	0.10	.0039
14	0.16	.0063	17	0.08	.0031
15	0.13	.0049	18	0.063	.0024
16	0.10	.0039	19	0.05	.0019

IQI SIZE	THICKNESS RANGE					
1 EN	40	thru	160 mm	1.6	thru	6.0 in.
6 EN	12.5	thru	50 mm	.50	thru	2.0 in.
10 EN	5.0	thru	20 mm	.20	thru	.75 in.
13 EN	2.5	thru	10 mm	.10	thru	.40 in.



PRATT & WHITNEY PENETRAMETERS

Pratt & Whitney specifies the use of two classifications of penetrameters under the XRM document: TAM specs, and AMS 2635.

TAM specs are tool numbers assigned to penetrameters with a true 2% sensitivity, for use on material sections under .25 in. TAM specs contain detail numbers, each one representing a specific penetrameter thickness. Additionally, TAM specs contain an AMS number, which specifies the material of the penetrameter.

AMS 2635 is used for all materials, for use on sections from .05 in. and up with a minimum IQI thickness of .005 in. For materials not covered by a TAM number, AMS 2635 can be made to true 2% thickness. Specify when ordering, otherwise the standard .005 in. minimum thickness applies.

TAM SPECS FOR PENETRAMETERS:

<u>TAM #</u>	<u>MATERIAL</u>	<u>AMS #</u>
108533	STAINLESS STEEL	5640
140607	6AL/4V TITANIUM	4928
142937	HASTELLOY X	5754
142401	HAYNES 25	5759

COMMON MATERIALS COVERED UNDER AMS 2635 C IN ADDITION TO THOSE LISTED ABOVE:

<u>MATERIAL</u>	<u>AMS #</u>
2024 ALUMINUM	4120
ZK60 MAGNESIUM	4352
WASPALLOY	5706

MATERIAL VERIFICATION:

Pratt & Whitney's XRM document specifies the requirement for dimensional and alloy verification.

Dimensions are verified and documented in an analytical report with penetrameters.

Alloy verification is performed in accordance with PWA MCL sec. F-53 (thermo-electric testing).

Material certifications accompany alloy verification document.

Aluminum and Magnesium alloys are sent out for semi-quantitative spectrographic analysis in accordance with PWA MCL sec. F-23 and F-54.

PRATT & WHITNEY MOUNTING BLOCKS

Pratt & Whitney specifies the use TAM specs to which mounting blocks shall conform. TAM specs are tool numbers assigned to mounting blocks. TAM specs contain detail numbers , each one representing a specific mounting block thickness. Additionally, TAM specs contain an AMS number, which specifies the material of the mounting block.

TAM SPECS FOR MOUNTING BLOCKS:

<u>TAM #</u>	<u>MATERIAL</u>	<u>AMS #</u>
97734	2024 ALUMINUM	4120
97735	ZK60 MAGNESIUM	4352
97736	6AL/4V TITANIUM	4928
97737	303 STAINLESS	5640
101017	WASPALLOY	5706
101018	HASTELLOY X	5754
142401	HAYNES 25	5759

MATERIAL VERIFICATION:

Pratt & Whitney's XRM document specifies the requirement for dimensional and alloy verification.

Dimensions are verified and documented in an analytical report with mounting blocks.

Alloy verification is performed in accordance with PWA MCL sec. F-53 (thermo-electric testing).

Material certifications accompany alloy verification document.

Aluminum and Magnesium alloys are sent out for semi-quantitative spectrographic analysis in accordance with PWA MCL sec. F-23 and F-54.

PRATT & WHITNEY STEP WEDGES

Pratt & Whitney's XRM document specifies step wedges conforming to TAM specs. TAM specs are tool numbers assigned to step wedges specifying material, width and length of the step wedge, step width, and step thicknesses.

DETAILS:

NUMBER of STEPS:	7
WIDTH (OVERALL):	2 1/4"
LENGTH (OVERALL):	3 15/16"
STEP WIDTH:	9/16"
STEP THICKNESSES:	.050", .075", .100", .125", .150", .200", .250"

TAM SPECS FOR STEP WEDGES:

<u>TAM #</u>	<u>MATERIAL</u>	<u>AMS #</u>
142395	6AL/4V TITANIUM	4928
142396	303 STAINLESS	5640
142398	WASPALLOY	5706
142399	HAYNES 25	5759
142939	HASTELLOY X	5754

MATERIAL VERIFICATION:

Pratt & Whitney's XRM document specifies the requirement for dimensional and alloy verification.

Dimensions are verified and documented in an analytical report with step wedges.

Alloy verification is performed in accordance with PWA MCL sec. F-53 (thermo-electric testing).

Material certifications accompany alloy verification document.

Aluminum and Magnesium alloys are sent out for semi-quantitative spectrographic analysis in accordance with PWA MCL sec. F-23 and F-54.

PRATT & WHITNEY X-RAY DENSITY COMPARISON GAGE

TAM 169526

GEOMETRY: 1.0" X 3.0" X .100"

Contains a series of 12, 1/16" diameter flat bottom holes from .005" to .060" deep. Normally manufactured from 6AL/4V TITANIUM, or 410 STAINLESS. Tool and hole numbers are permanently engraved. Housed in Mahogany wood case.

CONTRAST SENSITIVITY GAGES

ASTM E 1647

Used in conjunction with a high contrast resolution measuring gage such as a *DUPLEX WIRE IMAGE QUALITY INDICATOR (EN 462 PART 5)*; Contrast sensitivity gages measure contrast sensitivity independent of the imaging system spatial resolution limitations.

Contrast sensitivity gages are manufactured with four precision thickness recesses representing the four levels of contrast sensitivity to be measured- 1, 2, 3 and 4% as shown in figure 1 below. Contrast sensitivity gages are designed with four gage sizes. As tables 1, 2, and 3 indicate, each gage size covers a range of thicknesses.

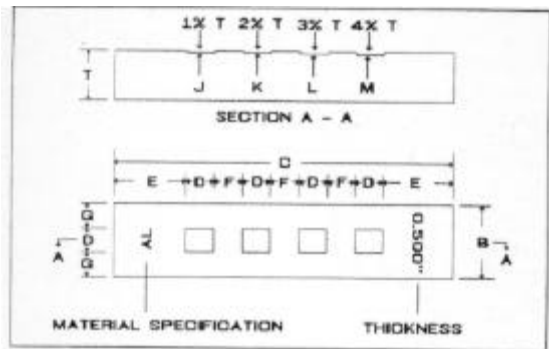


FIG. 1 General Layout of the Contrast Sensitivity Gage

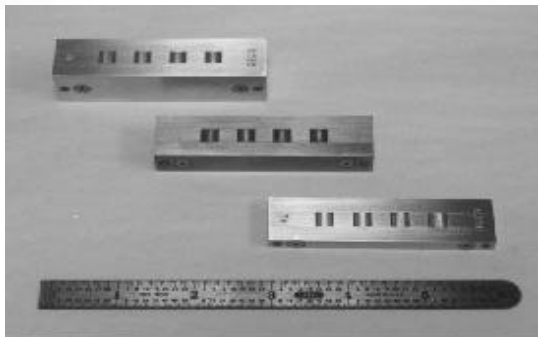


TABLE 1 Design of the Contrast Sensitivity Gage

Gage Thickness	J Recess	K Recess	L Recess	M Recess
T	1 % of T	2 % of T	3 % of T	4 % of T

TABLE 2 Contrast Sensitivity Gage Dimensions

Gage Size	B DIM.	C DIM.	D DIM.	E DIM.	F,G DIM.
1	0.750 in.	3.000 in.	0.250 in.	0.625 in.	0.250 in.
	19.05 mm	76.20 mm	6.35 mm	15.88 mm	6.35 mm
2	1.500 in.	6.000 in.	0.500 in.	1.250 in.	0.500 in.
	38.10 mm	152.40 mm	12.70 mm	31.75 mm	12.7 mm
3	2.250 in.	9.000 in.	0.750 in.	1.875 in.	0.750 in.
	57.15 mm	228.60 mm	19.05 mm	47.63 mm	19.05 mm
4	3.000 in.	12.000 in.	1.000 in.	2.500 in.	1.000 in.
	76.20 mm	304.80 mm	25.40 mm	63.50 mm	25.4 mm

TABLE 3 Contrast Sensitivity Gage Application

Gage Size	Use on Thicknesses
1	Up to 1.5 in. (38.1 mm)
2	Over 1.5 in. (38.1 mm) to 3.0 in. (76.2 mm)
3	Over 3.0 in. (76.2 mm) to 6.0 in. (152.4 mm)
4	Over 6.0 in. (152.4 mm)

Contrast sensitivity gages can be manufactured from in the following materials:

MAGNESIUM	(GROUP 03)
ALUMINUM	(GROUP 02)
TITANIUM	(GROUP 01)
STEEL OR STAINLESS STEEL (300 SERIES)	(GROUP 1)
ALUMINUM BRONZE ALLOY #623 OR #630	(GROUP 2)
NI-CR-FE (INCONEL 600)	(GROUP 3)
70 to 30 NICKEL COPPER (MONEL) or	(GROUP 4)
70 to 30 COPPER NICKEL (CU-NI)	
TIN BRONZE alloy D of B 139	(GROUP 5)

MOUNTING BLOCKS

Mounting blocks are used when it is impractical to place the penetrameter directly on the object being radiographed. Most codes specify that a mounting block of the same material and thickness be placed, with the penetrameter, adjacent to the part in such a manner that it will show clearly on the radiograph. Standard mounting blocks are supplied in sizes corresponding with IQI sizes.

GENERAL DIMENSIONS:

SIZES UP TO 2 1/2" incl.	1.0" X 2 1/4"
SIZES OVER 2 1/2"	1 1/4" X 3.0"

These dimensions allow at least 1/8" clearance on three sides of the IQI.

Standard mounting blocks are available in the following materials:

STEEL	MAGNESIUM
BRASS	STAINLESS STEEL
ALUMINUM	COPPER

Mounting blocks of other materials including, but not limited to, the following materials are made on order:

HASTELLOY X	MAGNESIUM-THORIUM
MONEL	CUPRO-NICKEL
INCONEL	6AL/4V TITANIUM
ALUMINUM BRONZE	HAYNES 25

SHIMS

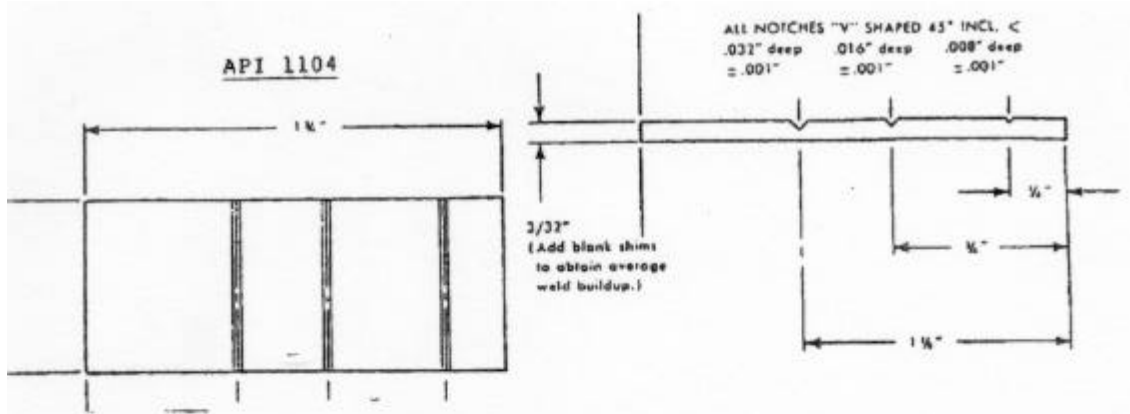
3/4" X 2"

Some codes require that shims be placed under the penetrameter to compensate for the thickness of a backing ring or weld reinforcement. Shims are supplied in the same materials as penetrameters. They are usually available in increments of 1/16", from 1/16" thick thru 1.0". The general dimension (3/4" x 2") allows approximately 1/8" clearance on each side of the penetrameter they are to be used with. Material and thickness is marked on each shim.

NOTE:

"SHIMS" (3/4" X 2") ARE NOT TO BE USED FOR APPLICATIONS REQUIRING CONFORMANCE TO ASTM-E-1742 (formerly MIL-STD-453)

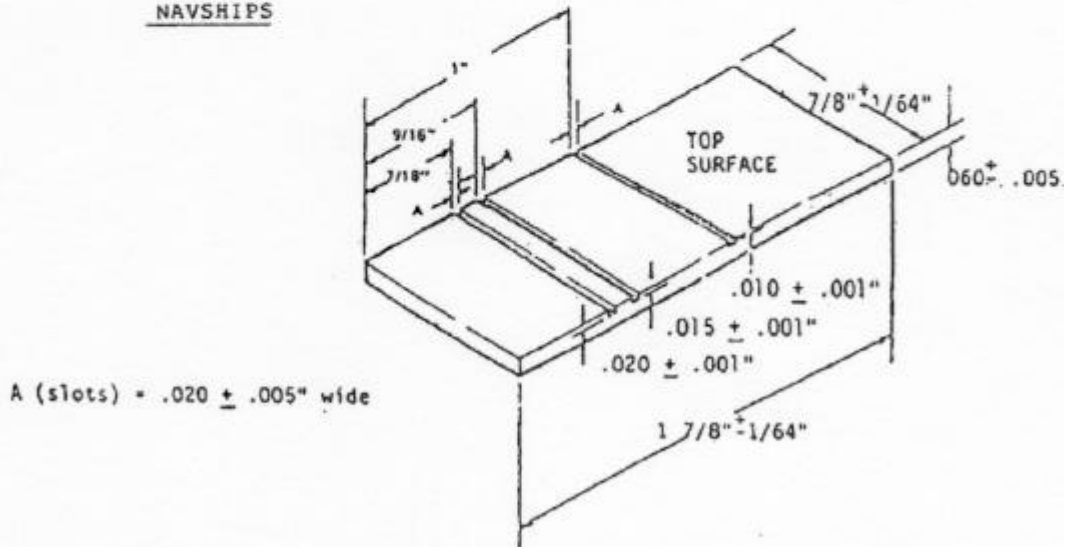
COMPARATOR SHIMS (SLOTTED SHIMS)



TOLERANCES: Notch locations $\pm 1/64"$
Dimensions should exceed Penetrometer size by at least $1/8"$ on three sides.

NOTE: This configuration can be used in conjunction with or in lieu of Penetrometer shims as required by par. 8.4. Other configurations and dimensions may be used provided notches are "V" shaped and depth tolerances are $\pm 0.001"$.

NAVSHIPS



NOTES:

1. Top and bottom surfaces of shims to be parallel within $\pm .001$ of an inch.
2. The bottom surfaces of the slots must be parallel to the bottom surface of the shim within $\pm .001$ of an inch.
3. All fractional dimensions to be within $\pm 1/64"$.

STEP WEDGES

Step wedges are used for the calibration of X-RAY machines and evaluation of techniques. Additionally, when an object with varying thicknesses is radiographed a step wedge of the same material, incorporating the same thicknesses, may often be advantageously used. By placing an IQI on each step, and including the step wedge in the radiograph, the sensitivity may be suitably determined for each thickness.

Standard step wedges, 1" high and 2" or 2 1/4" wide, with 4, 8, or 16 steps are manufactured in all standard materials and are available for prompt delivery. Step wedges of other materials and alloys are made on order. Delivery is within two weeks.

GENERAL DIMENSIONS:

	<u>4 STEPS</u>	<u>8 STEPS</u>	<u>16 STEPS</u>
STEP HEIGHT:	.250"	.125"	.062"
STEP WIDTH:	.750"	.750"	.500"
STEP WEDGE LENGTH	3.000"	6.000"	8.000"

SPECIAL STEP WEDGES

Step wedges, with a continuous series of steps, to any height and width are manufactured to customers' specifications. Descriptions or drawings must include the width and length of the step wedge, step dimensions, total number of steps, and total height of the step wedge.

RISER BLOCKS

Step wedge blocks (riser blocks) increase the effective thickness of the step wedge. The general dimensions correspond with the step wedge for which it is to be used, and the block is 1.0" thick.



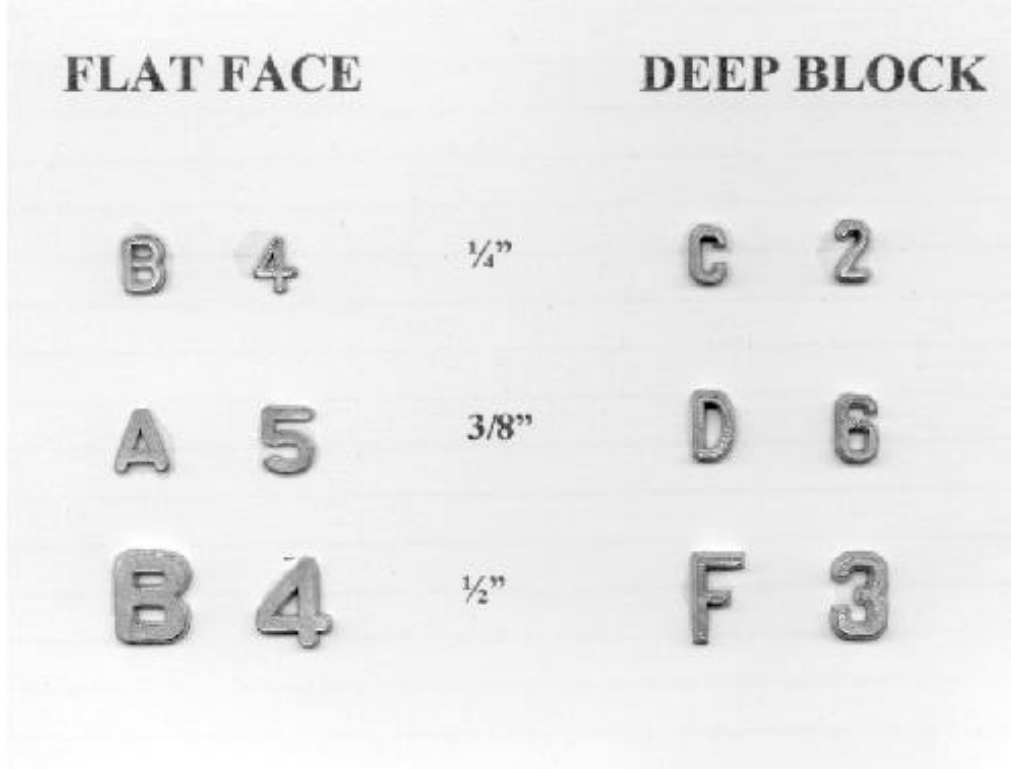
LEAD NUMBERS AND LETTERS

DETEK precision lead numbers and letters are clean with sharp smooth edges, and produce clear, well defined images.

All types shown below are available in A - Z, and #0 - #9. Immediate delivery from factory stock. Samples available on request. Arrows are also available.

DETEK also offers 36 compartment lead figure cases made of heavy duty plastic.

COMMON SIZES



DATA

SIZE	TYPE	THICKNESS	SIZE	TYPE	THICKNESS
1/8"	FLAT FACE	.020" - .025"	1/4"	DEEP BLOCK	5/64"
3/16"	FLAT FACE	.035" - .040"	3/8"	DEEP BLOCK	5/64"
1/4"	FLAT FACE	3/64"	1/2"	DEEP BLOCK	5/64"
3/8"	FLAT FACE	3/64"	3/4"	DEEP BLOCK	3/32"
1/2"	FLAT FACE	1/16"	1"	DEEP BLOCK	1/8"
5/8"	FLAT FACE	1/16"			
1/4"	ARROWS	.030" - .040"	1/2"	INDUSTRIAL	1/4"
1/2"	ARROWS	1/16"	3/4"	INDUSTRIAL	1/4"
5/8"	ARROWS	1/16"	1"	INDUSTRIAL	1/4"
1"	ARROWS	1/16"			
1 1/4"	ARROWS	3/32"			
1 1/2"	ARROWS	3/32"			

NOTE: Thicknesses listed are approximate, some variances occur due to the nature of casting



NONDESTRUCTIVE TESTING EQUIPMENT

Magnetic Source Tube Stands



Item	Description
2-Point Removable	2-Point Magnet Stand with Aluminum Base, two 100lb Magnets, Stainless Steel 3/4-16 Adapter, and 18" Long 3/4-16 Threaded Stainless Steel Tube
3-Point Removable	3-Point Magnet Stand with Aluminum Base, three 100lb Magnets, Stainless Steel 3/4-16 Adapter, and 18" Long 3/4-16 Threaded Stainless Steel Tube
4-Point Removable	4-Point Magnet Stand with Aluminum Base, four 100lb Magnets, Stainless Steel 3/4-16 Adapter, and 18" Long 3/4-16 Threaded Stainless Steel Tube
2-Point SS	2-Point Magnet Stand with Stainless Steel Base, two 100lb Magnets, and welded 18" long 1/2" dia Stainless Steel Tube or Rod (3/4" dia tube also available)
3-Point SS	3-Point Magnet Stand with Stainless Steel Base, three 100lb Magnets, and welded 18" long 1/2" dia Stainless Steel Tube or Rod (3/4" dia tube also available)
4-Point SS	4-Point Magnet Stand with Stainless Steel Base, four 100lb Magnets, and welded 18" long 1/2" dia Stainless Steel Tube or Rod (3/4" dia tube also available)
2-Point AL	2-Point Magnet Stand with Aluminum Base, two 100lb Magnets, and welded 18" long 1/2" dia Aluminum Rod (3/4" dia Rod also available)
3-Point AL	3-Point Magnet Stand with Aluminum Base, three 100lb Magnets, and welded 18" long 1/2" dia Aluminum Rod (3/4" dia Rod also available)
4-Point AL	4-Point Magnet Stand with Aluminum Base, four 100lb Magnets, and welded 18" long 1/2" dia Aluminum Rod (3/4" dia Rod also available)

6805 COOLRIDGE DR ■ TEMPLE HILLS MD 20748
301-449-7300 ■ 800-638-0554 ■ FAX 301-449-7011
EMAIL: sales@detek.com

SPEC Tungsten Collimators

Producing higher-resolution images while effectively reducing radiation levels on the job site.

THE ADVANTAGES OF COLLIMATORS

Collimators are one of the most effective means available for reducing the radiation levels on a job site. Collimators also increase the quality of radiography shots by reducing the amount of scatter radiation that reaches the film. Collimators help reduce your restricted area and aid in obtaining As Low As Reasonably Achievable (ALARA) radiation levels. This translates into safer operating conditions for radiographers.

WHY USE TUNGSTEN?

Because tungsten is a more effective shielding material than lead and is an easy-to-handle, non-licensed material, it makes a very effective shielding material. Another feature of the tungsten collimator is that it does not spark, so it is ideal for plant operations. In addition to the standard collimators listed at right, SPEC can build a collimator to your specifications.



Panoramic degree collimators



Side port 90 degree collimators

SPEC SIDE PORT 90 DEGREE MINIMUM BEAM ANGLE COLLIMATORS

ITEM DESCRIPTION	ITEM #
5 Half Value Layers "Mini" Collimator Attaches to the end piece of the source tube and is able to fit into tight spaces. This is the most economical and versatile of all of our collimators. 1-1/2" Diameter x 1-7/8" Length; Weight: 1.75 lbs. Attenuation Factor Iridium-192 (3.125 X 10 ⁻²) 1/32	231001
5 Half Value Layers Slotted Collimator Attaches to the end piece of the source tube and is slotted to sit on the weld. The slot makes it easier to center the weld. 1-1/2" Diameter x 1 7/8" Length; Weight 1.75 lbs. Attenuation Factor Iridium-192 (3.125 X 10 ⁻²) 1/32	231005
8 Half Value Layers Collimator Attaches to the end piece of the source tube. This collimator offers a greater amount of shielding and is still able to fit into small spaces. Best used in situations where distance from the source is a factor. 2" Diameter x 2-5/16" Length; Weight 4.25 lbs. Attenuation Factor Iridium-192 (3.9 X 10 ⁻³) 1/256.	231002
16 Half Value Layers Collimator Attaches to the end of the source tube. The collimator offers even greater shielding, and it is much bulkier than the mini collimator. 3" Diameter x 3 2/5" Length; Weight 16.75 lbs. Attenuation Factor Iridium-192 (1.54 X 10 ⁻⁵) 1/65000.	231006

SPEC PANORAMIC 360-DEGREE BEAM COLLIMATORS

ITEM DESCRIPTION	ITEM #
4 Half Value Layers Collimator Emits a 360 degree beam around the center and is shielded on the ends. The collimator is best used for taking shots of pipe welds, or tubulars from the inside. 1-1/2" Diameter x 3-1/2" Length; Weight 1.75 lbs. Attenuation Factor Iridium-192 (6.25 X 10 ⁻²) 1/16.	231003
8 Half Value Layers Collimator Emits a 360 degree beam around the center and offers a greater amount of shielding on the ends. The collimator is used for radiographing from the inside of pipe. 1-9/16" Diameter x 4-1/4" Length; Weight 2.5 lbs. Attenuation Factor Iridium-192 (3.9 X 10 ⁻³) 1/256.	231004
13.5 Half Value Layers Collimator Emits a 360 degree beam around the center and offers an even greater amount of shielding on the ends. The collimator is used to radiograph pipe from the inside. 2 1/4" Diameter x 8" Length; Weight 5.5 lbs. Attenuation Factor Iridium-192 (3.08 X 10 ⁻⁵) 1/32500.	231015



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