How to Read the ANSI Tables for Inspections Based on Random Sampling

How to read the "ANSI tables", aka "AQL tables"

Source: Mil-Std 105E, replaced by commercial standards:

ISO2859, ANSI/ASQ Z1.4-2003, NF06-022, BS 6001, DIN 40080.

Random Sampling

- □ 100% inspection can be time-consuming, or destructive.
- How many samples to check?
- Follow statistics rather than a fixed percentage
- Widely used settings:
 - Normal severity
 - Level II

Acceptance Quality Limit (AQL)

- How to decide if the batch is accepted or rejected?
- The buyer and the supplier should agree on AQLs.
- Widely used settings for consumer goods in China:
 - 0% for critical defects (totally unacceptable: a user might get harmed, or regulations are not respected).
 - 2.5% for major defects (these products would usually not be considered acceptable by the end user).
 - 4.0% for minor defects (there is some departure from specifications, but most users would not mind it).

Example

- Order size: 40,000 pcs of memory sticks, to be made in 1 batch by the supplier.
- Single sampling plan.
- Normal severity, level II.
- □ AQLs: critical 0, major 1.5%, minor 4.0%.

Step 1: the Code Letter

Table 1 - Sample size code letters (see 10.1 and 10.2)

Lo	t size		Special insp	ection levels	•	Gener	al inspection	levels
		S-1	S-2	S-3	S-4	1	=	Ш
2 to	8	А	Α	А	А	Α	А	В
9 to	15	Α	Α	Α	Α	Α	В	С
16 to	25	А	А	В	В	В	С	D
26 to	50	А	В	В	С	С	D	E
51 to	90	В	В	С	С	С	E	F
91 to	150	В	В	С	D	D	F	G
151 to	280	В	С	D	E	E	G	н
281 to	500	В	С	D	E	F	н	J
501 to	1 200	С	С	E	F	G	J	к
1 201 to	3 200	С	D	E	G	н	к	L
3 201 to	10 000	С	D	F	G	J	L	М
10 001 to	35 000	С	D	F	н	к	М	N
35 001 to	150 000	D	E	G	J	L	N	Р
150 001 to	500 000	D	Е	G	J	М	Р	Q
500 001 and	over	D	E	н	К	N	Q	R

Step 2: Sample Size and AQLs

Table 2-A — Single sampling plans for normal inspection (Master table)

Sample						Acc	eptance	e qualit	y limit,	AQL, i	n perce	ent non	confor	ming ite	ems an	d nonc	onform	ities p	er 100	items (norma	l inspe	ction)				
size code	Sample size	0,010	0,015	0,025	0,040	0,065	0,10	0,15	0,25	0,40	0,65	1,0	1,5	2,5	4,0	6,5	10	15	25	40	65	100	150	250	400	650	1 000
letter		Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re
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^{🞝 =} Use the first sampling plan below the arrow. If sample size equals, or exceeds, lot size, carry out 100 % inspection.

Ac = Acceptance number

Table 2-A — Single sampling plans for normal inspection (Master table)

Sample						Acc	eptance	e qualit	y limit,	AQL, i	n perce	ent nor	nconfor	ming it	ems an	d nonc	conform	nities p	er 100	items (norma	l inspe	ction)				
size code	Sample size	0,010	0,015	0,025	0,040	0,065	0,10	0,15	0,25	0,40	0,65	1,0	1,5	2,5	4,0	6,5	10	15	25	40	65	100	150	250	400	650	1 000
letter		Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re
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^{🞝 =} Use the first sampling plan below the arrow. If sample size equals, or exceeds, lot size, carry out 100 % inspection.

Ac = Acceptance number

 $[\]mathbf{\hat{Q}}$ = Use the first sampling plan above the arrow.

Table 2-A — Single sampling plans for normal inspection (Master table)

Sample						Acc	eptanc	e qualit	y limit,	AQL, i	n perce	ent nor	confor	ning it	ems an	d nonc	onform	ities p	er 100	items (norma	l inspe	ction)				
size code	Sample size	0,010	0,015	0,025	0,040	0,065	0,10	0,15	0,25	0,40	0,65	1,0	1,5	2,5	4,0	6,5	10	15	25	40	65	100	150	250	400	650	1 000
letter		Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re
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□ = Use the first sampling plan below the arrow. If sample size equals, or exceeds, lot size, carry out 100 % inspection.

 $\mathbf{\hat{G}}$ = Use the first sampling plan above the arrow.

Ac = Acceptance number

This Special Case

- The ISO2859-1 standard says:
 - ☐ If this procedure leads to different sample sizes for different classes of nonconformities or nonconforming items, the sample size code letter corresponding to the largest sample size derived may be used for all classes of nonconformities or nonconforming items, when designated or approved by the responsible authority.

Conclusion (for Single Plan)

- Your code letter is "N", so you will have to draw 500 pcs randomly from the total lot size.
- Here are the limits: the products are accepted if NO critical defects, and NO MORE than 14 major defects, and NO MORE than 21 minor defects are found.
- Examples:
 - If you find 0 critical defect, 17 major defects and 12 minor defects, the products are rejected.
 - If you find 0 critical defect, 10 major defects and 21 minor defects, the products are accepted.

Same Example, Double Plan

- For simplicity, let's only look at major defects.
- Code letter is unchanged.

Table 1 - Sample size code letters (see 10.1 and 10.2)

Lo	t size		Special insp	ection levels	:	Gener	al inspection	levels
		S-1	S-2	S-3	S-4	1	Ш	Ш
2 to	8	А	Α	Α	А	Α	А	В
9 to	15	Α	Α	Α	Α	Α	В	С
16 to	25	А	Α	В	В	В	С	D
26 to	50	А	В	В	С	С	D	E
51 to	90	В	В	С	С	С	E	F
91 to	150	В	В	С	D	D	F	G
151 to	280	В	С	D	E	E	G	н
281 to	500	В	С	D	E	F	н	J
501 to	1 200	С	С	E	F	G	J	к
1 201 to	3 200	С	D	E	G	н	к	L
3 201 to	10 000	С	D	F	G	J	L	М
10 001 to	35 000	С	D	F	н	к	М	N
35 001 to	150 000	D	E	G	J	L	N	Р
150 001 to	500 000	D	Е	G	J	М	Р	Q
500 001 and	over	D	E	н	К	N	Q	R

Table 3-A — Double sampling plans for normal inspection (Master table)

Sample			Cumu-						Acce	ptance	quality	limit,	AQL, i	n perce	ent nor	nconfor	ming it	ems an	nd none	conform	nities p	oer 100) items	(norma	al insp	ection)				
size	Sample	Sample	lative sample	0,010	0,0	15	0,025	0,040	0,065	0,10	0,15	0,25	0,40	0,65	1,0	1,5	2,5	4,0	6,5	10	15	25	40	65	100	150	250	400	650	1 000
letter			size	Ac R	e Ac f	Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re
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 ^{□ =} Use the first sampling plan below the arrow. If sample size equals, or exceeds, lot size, carry out 100 % inspection.

Ac = Acceptance number

^{* =} Use the corresponding single sampling plan (or alternatively use the double sampling plan below, where available).

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Conclusion (for Double Plan)

- □ 1st step: draw 315 samples and check them.
 - If you find 7 defects or less: the lot is accepted.
 - If you find 11 defects or more: the lot is rejected.
 - If you find between 8 and 10 defects: go for 2nd step.
- □ 2nd step: draw <u>another</u> 315 samples and check them.
 - If you find 18 defects or less in total: the lot is accepted.
 - If you find 19 defects or more in total: the lot is rejected.

Thank You

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