

Why the ANSI Tables are More Favorable to the Supplier

Analyzing 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.

A Sampling Plan Cannot Always Be Right

	Good Quality	Bad Quality
Accepted	✓	✗
Rejected	✗	✓

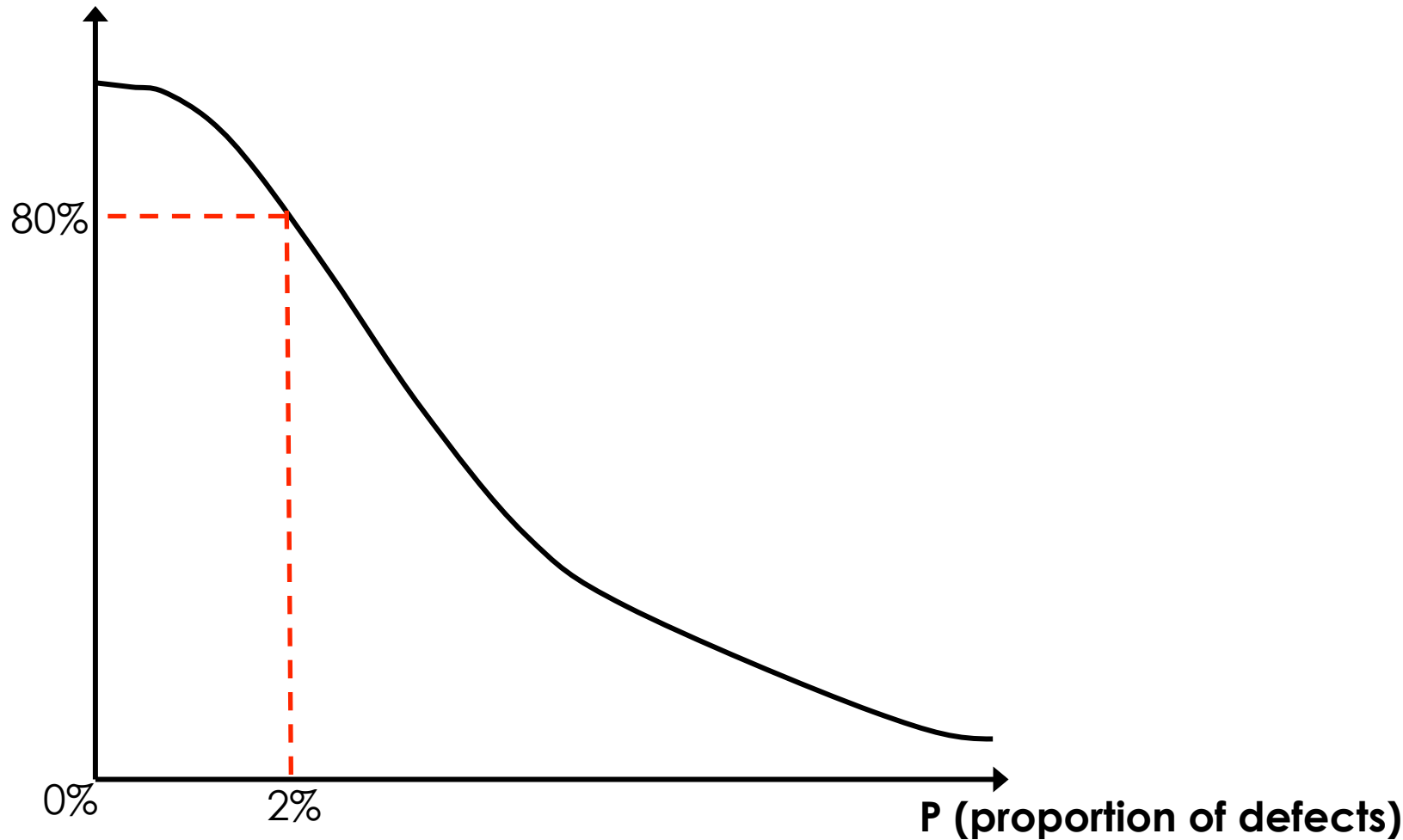
Two Types of errors

	Good Quality	Bad Quality
Accepted	✓	Buyer's risk <i>β risk</i> Type II error
Rejected	Supplier's risk <i>α risk</i> Type I error	✓

The OC Curve

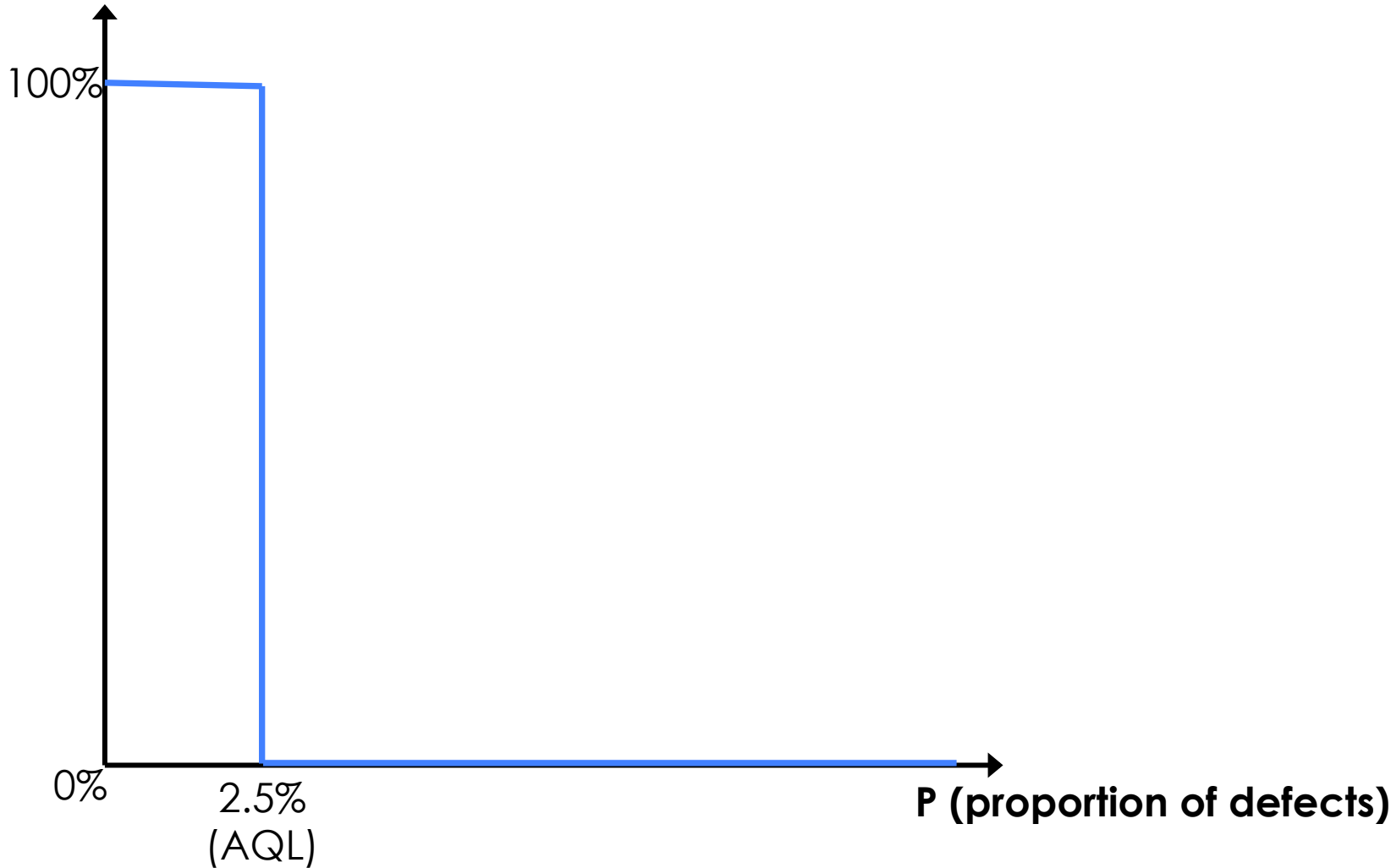
- The operating characteristics curve shows, for a given sampling plan, what the probability of acceptance is.

Pa (Probability of acceptance)



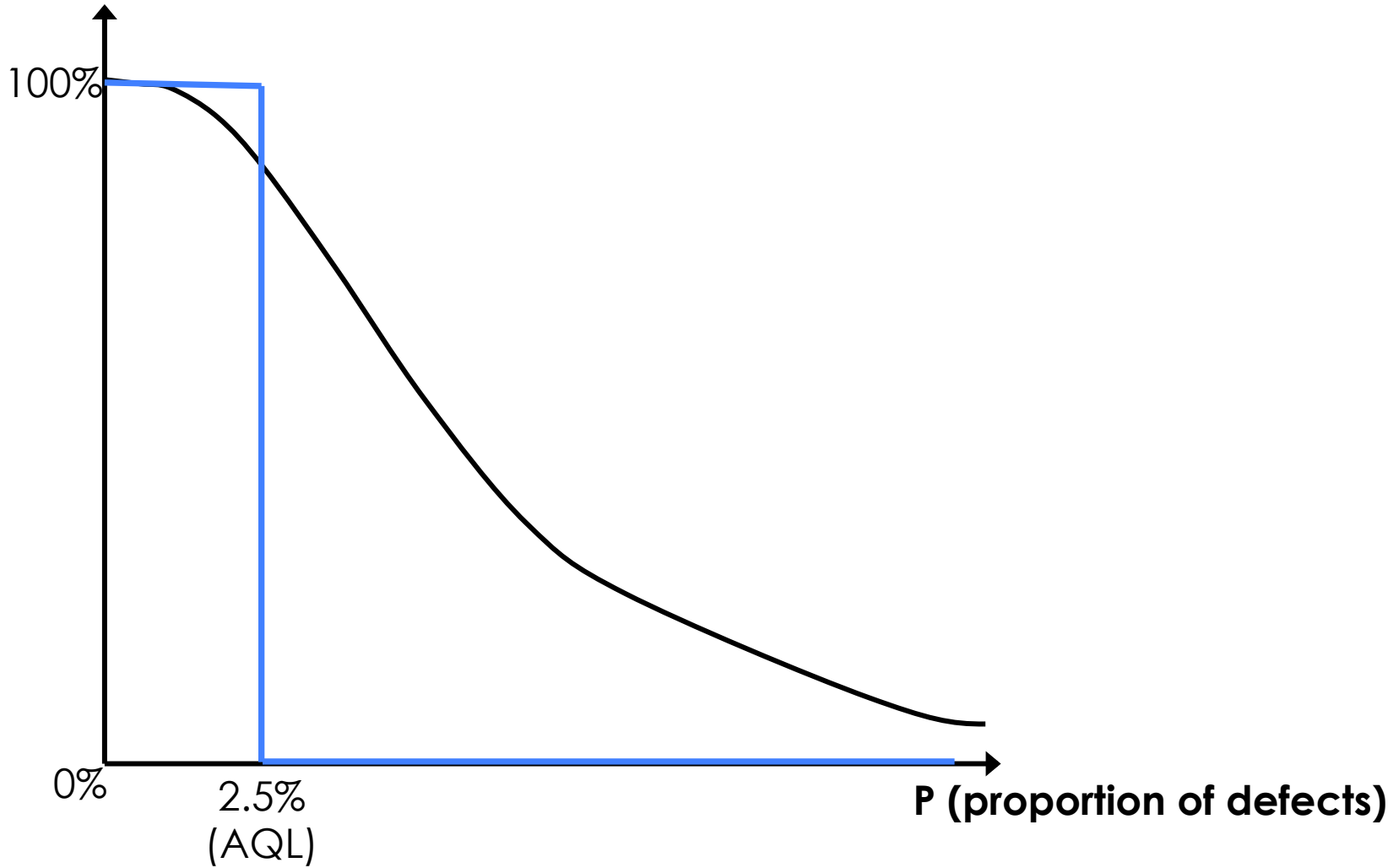
In this case: if there are 2% of defects, the lot will be accepted 80% of the time.

Pa (Probability of acceptance)



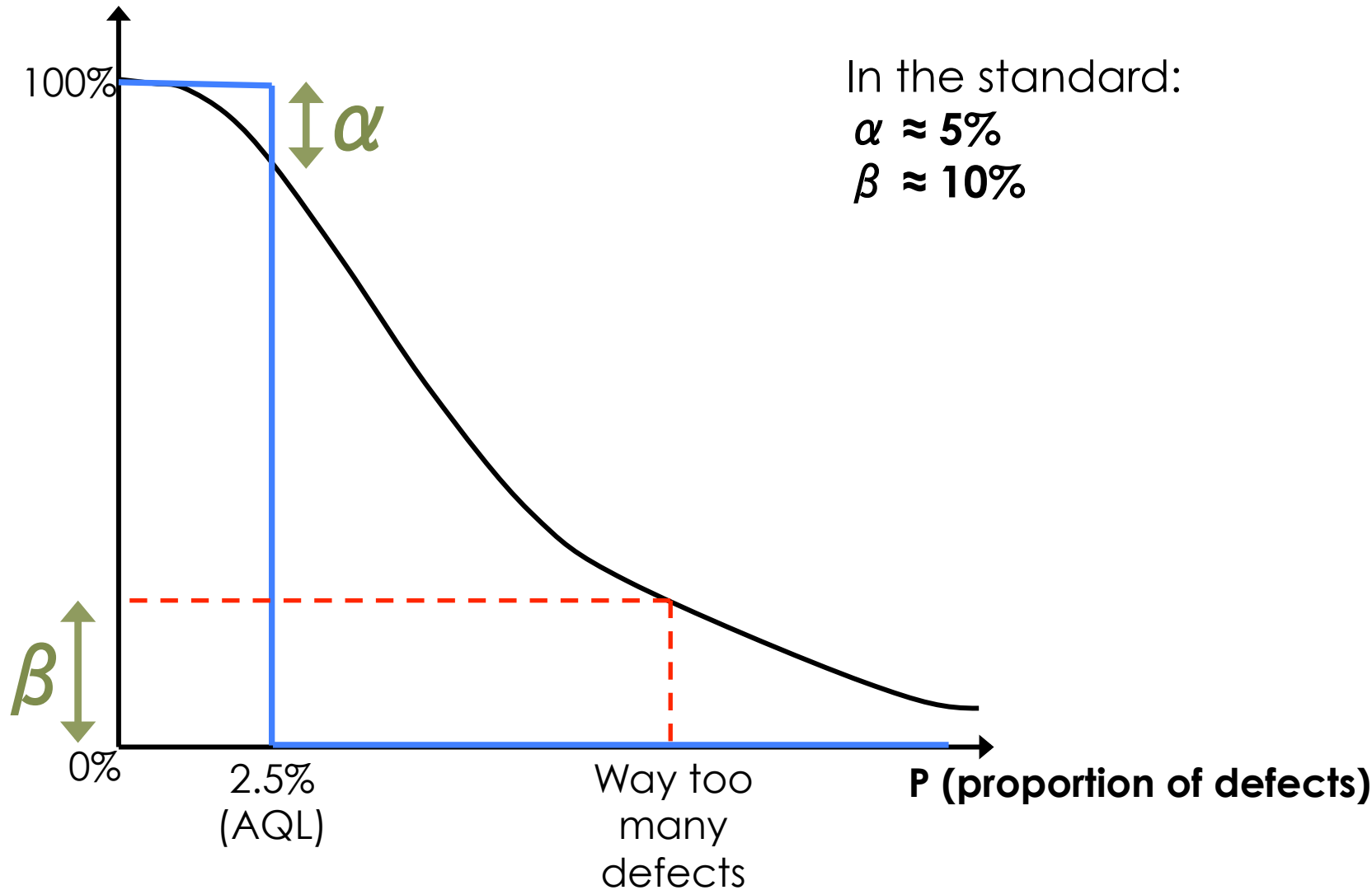
The ideal OC curve: ALWAYS accept up to AQL, ALWAYS reject above AQL.

Pa (Probability of acceptance)



A good OC curve is close to the ideal OC curve.

Pa (Probability of acceptance)



The supplier's risk is around 5% while the buyer's risk is around 10%!

More Favorable to the Supplier

- Even with an AQL of 1.0%, the buyer might receive a high proportion of defects.

Table 6-A — Consumer's risk quality for normal inspection

(in percent nonconforming for single sampling plans, for inspection for percent nonconforming)

Sample size code letter	Sample size	Acceptance quality limit, AQL, percent nonconforming items																						
		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							
A	2																68,4	69,0*						
B	3																53,6	54,1*	57,6*					
C	5															36,9	37,3*	39,8*	58,4					
D	8																							
E	13																							
F	20																							
G	32																							
H	50																							
J	80																							
K	125																							
L	200																							
M	315																							
N	500																							
P	800																							
Q	1 250																							
R	2 000																							

NOTES

1 At the consumer's risk quality, 10% of lots will be expected to be accepted.

2 All the values are based on the binomial distribution.

3 Superscript * denotes that the value is for the optional fractional acceptance number sampling plan (see Table 11-A).

More Favorable to the Supplier

- $500 \times 1.5\% = 7.5$
- So, if sample size is 500 and if AQL is 1.5%, the rejection limit should be 8, right?
- NO. It is 15.

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

Sample size code letter	Sample size	Acceptance quality limit, AQL, in percent nonconforming items and nonconformities per 100 items (normal inspection)																											
		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		
		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	Ac Re	
A	2	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	0 1	↓	↓	1 2	2 3	3 4	5 6	7 8	10 11	14 15	21 22	30 31		
B	3	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	0 1	↑	↓	1 2	2 3	3 4	5 6	7 8	10 11	14 15	21 22	30 31	44 45	
C	5	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	0 1	↑	↓	1 2	2 3	3 4	5 6	7 8	10 11	14 15	21 22	30 31	44 45	↑
D	8	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	0 1	↑	↓	1 2	2 3	3 4	5 6	7 8	10 11	14 15	21 22	30 31	44 45	↑
E	13	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	0 1	↑	↓	1 2	2 3	3 4	5 6	7 8	10 11	14 15	21 22	30 31	44 45	↑
F	20	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	0 1	↑	↓	1 2	2 3	3 4	5 6	7 8	10 11	14 15	21 22	↑	↑	↑
G	32	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	0 1	↑	↓	1 2	2 3	3 4	5 6	7 8	10 11	14 15	21 22	↑	↑	↑
H	50	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	0 1	↑	↓	1 2	2 3	3 4	5 6	7 8	10 11	14 15	21 22	↑	↑	↑
J	80	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	0 1	↑	↓	1 2	2 3	3 4	5 6	7 8	10 11	14 15	21 22	↑	↑	↑
K	125	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	0 1	↑	↓	1 2	2 3	3 4	5 6	7 8	10 11	14 15	21 22	↑	↑	↑
L	200	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	0 1	↑	↓	1 2	2 3	3 4	5 6	7 8	10 11	14 15	21 22	↑	↑	↑
M	315	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	0 1	↑	↓	1 2	2 3	3 4	5 6	7 8	10 11	14 15	21 22	↑	↑	↑
N	500	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	0 1	↑	↓	1 2	2 3	3 4	5 6	7 8	10 11	14 15	21 22	↑	↑	↑
P	800	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	0 1	↑	↓	1 2	2 3	3 4	5 6	7 8	10 11	14 15	21 22	↑	↑	↑
Q	1 250	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	0 1	↑	↓	1 2	2 3	3 4	5 6	7 8	10 11	14 15	21 22	↑	↑	↑
R	2 000	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	0 1	↑	↓	1 2	2 3	3 4	5 6	7 8	10 11	14 15	21 22	↑	↑	↑

↓ = Use the first sampling plan below the arrow. If sample size equals, or exceeds, lot size, carry out 100 % inspection.

↑ = Use the first sampling plan above the arrow.

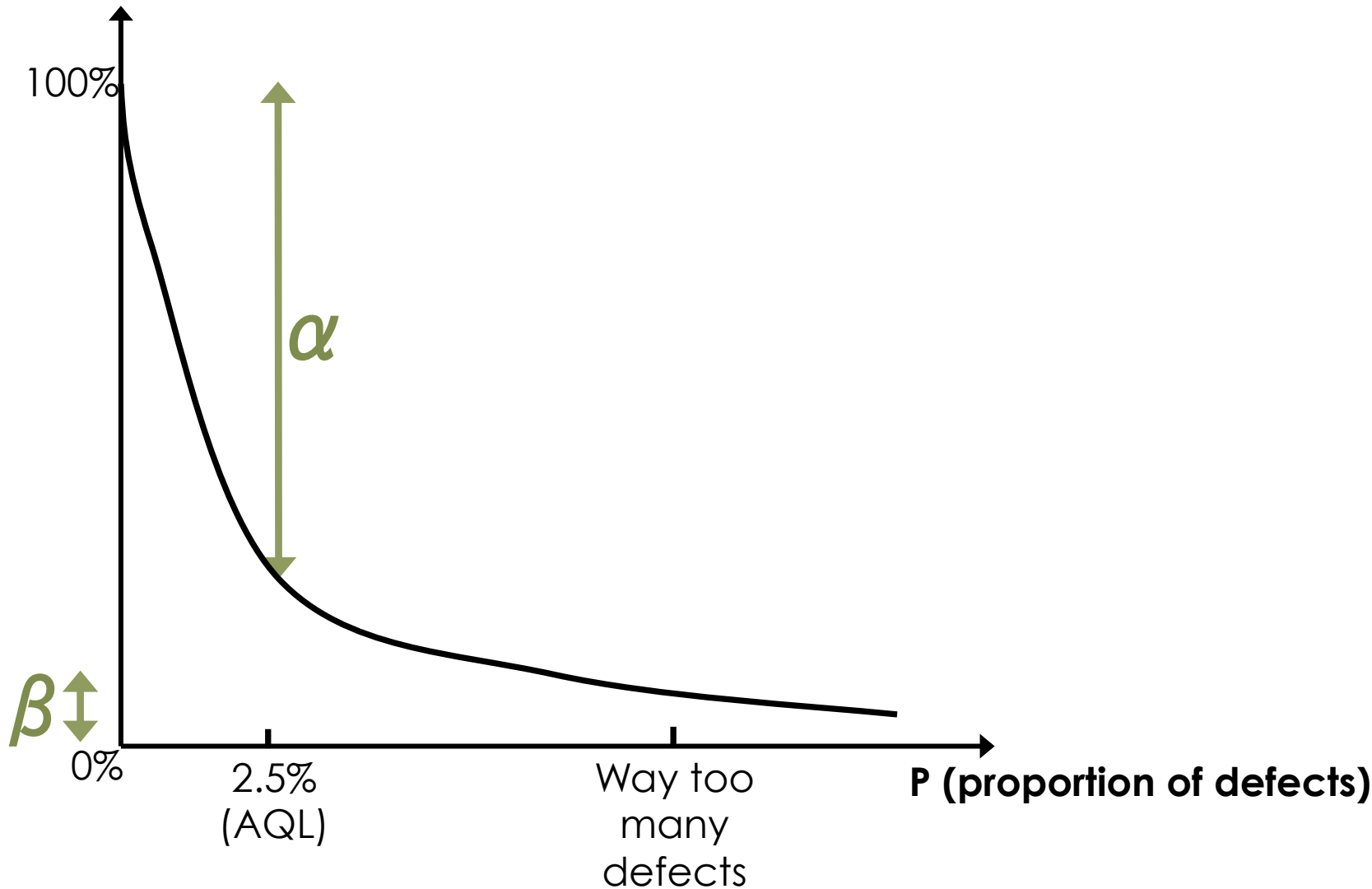
Ac = Acceptance number

Re = Rejection number

How About “Accept On Zero”?

- “Accept on zero” plans have become popular in the North-American auto industry.
- We generally don’t advise such plans.
- They protect the buyer much more than the supplier.

Pa (Probability of acceptance)



"Accept on zero" plan: much less favorable to the supplier.

Conclusion

- Inspections based on these sampling plans are good at avoiding widespread problems, and at maintaining pressure on the manufacturer.
- But don't fool yourself with the meaning of the AQL!
- The buyer should try to work with good manufacturers in the first place, and should help those that need to improve.

Thank You

- For more articles and videos on this topic:
 - Go to www.qualityinspection.org