

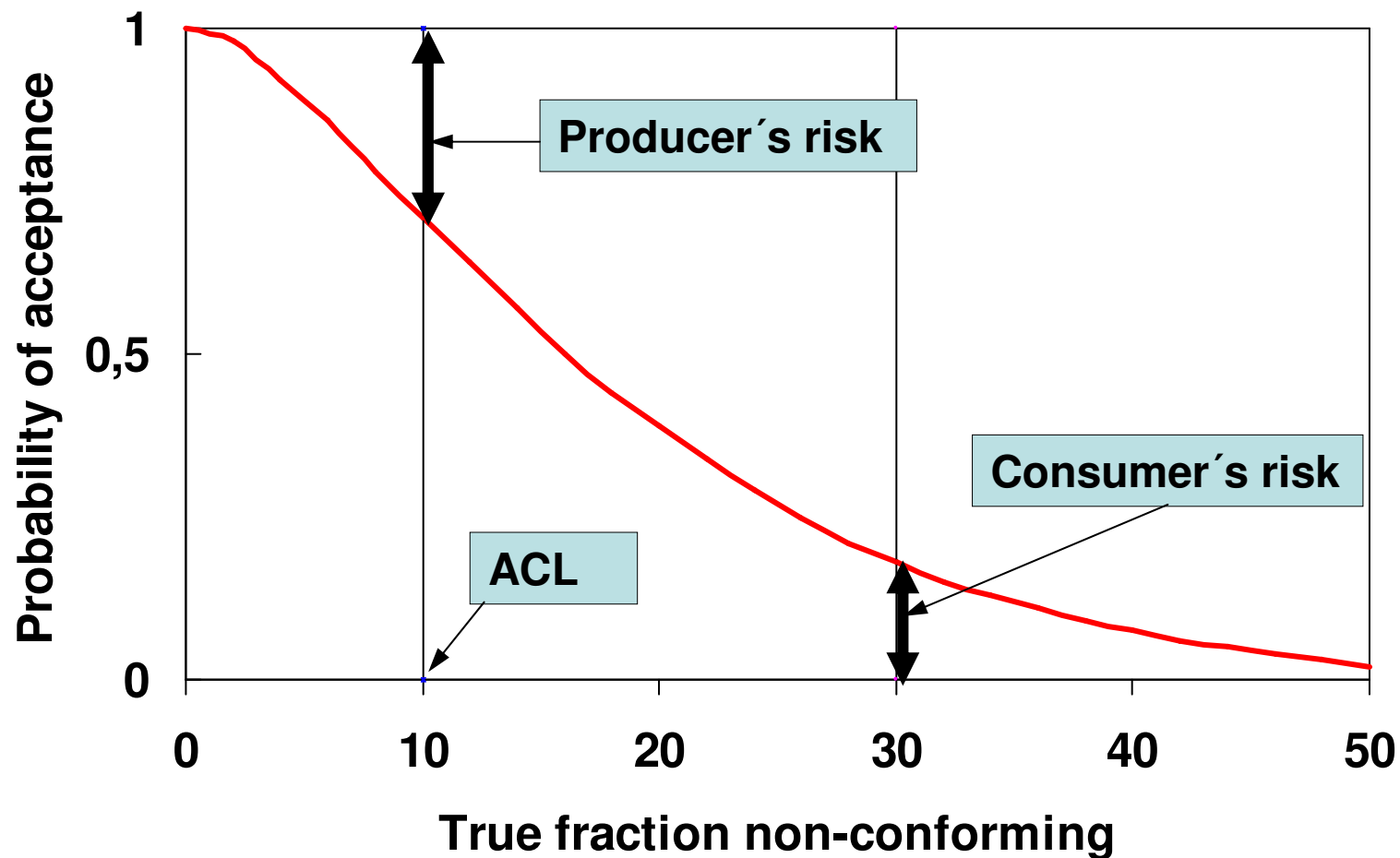
'Equivalent' conformity criteria for inspection of aggregate products

Metodgruppen den 8 maj 2012

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Efficiency of the inspection method

The discriminatory ability is indicated by the slope of the OC-curve
(OC = operating characteristic)
(ACL = worst tolerable process non-conforming)



ISO/TR 8550-1 Acceptance sampling

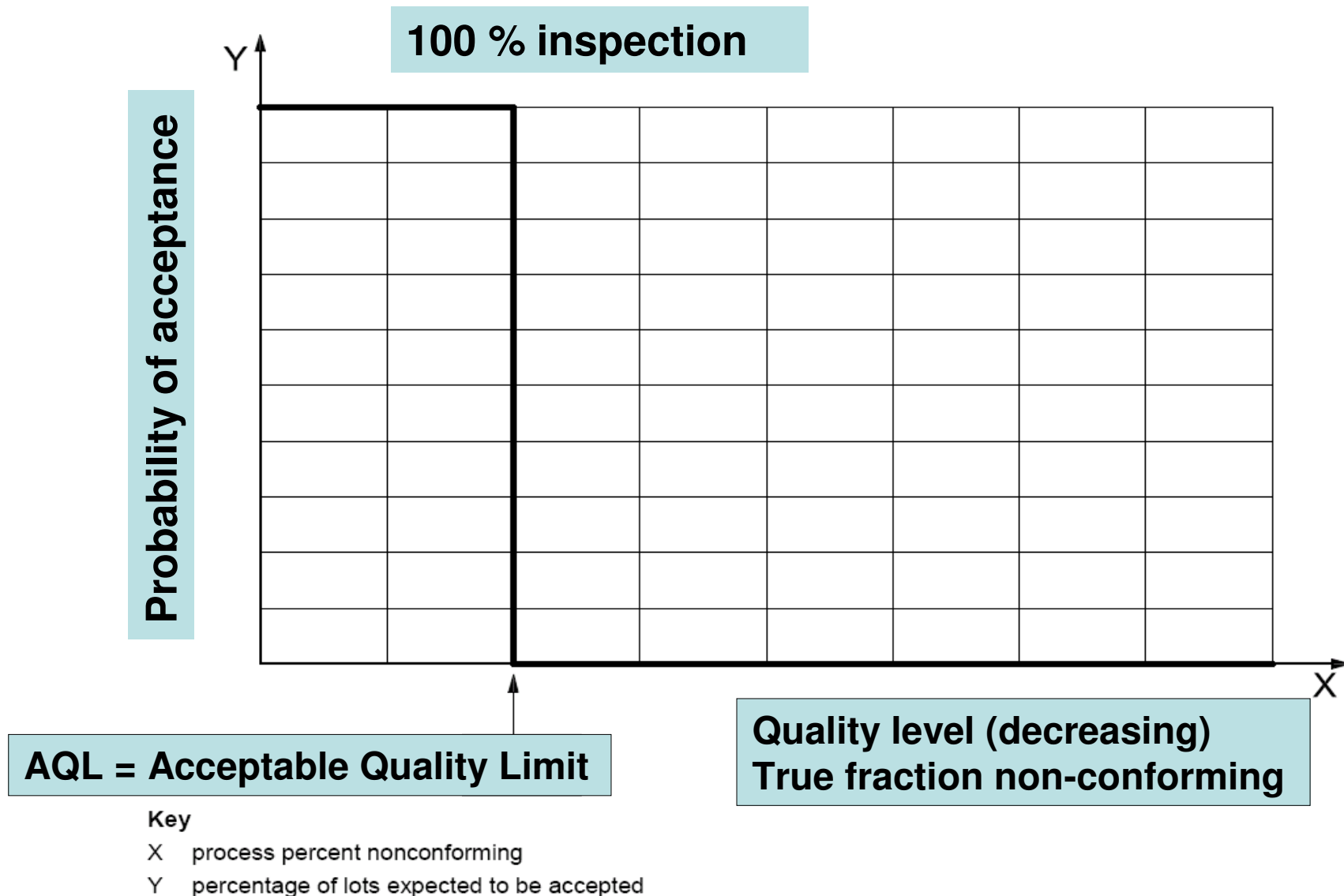


Figure 3 — Ideal operating characteristic curve

ISO/TR 8550-1 Acceptance sampling

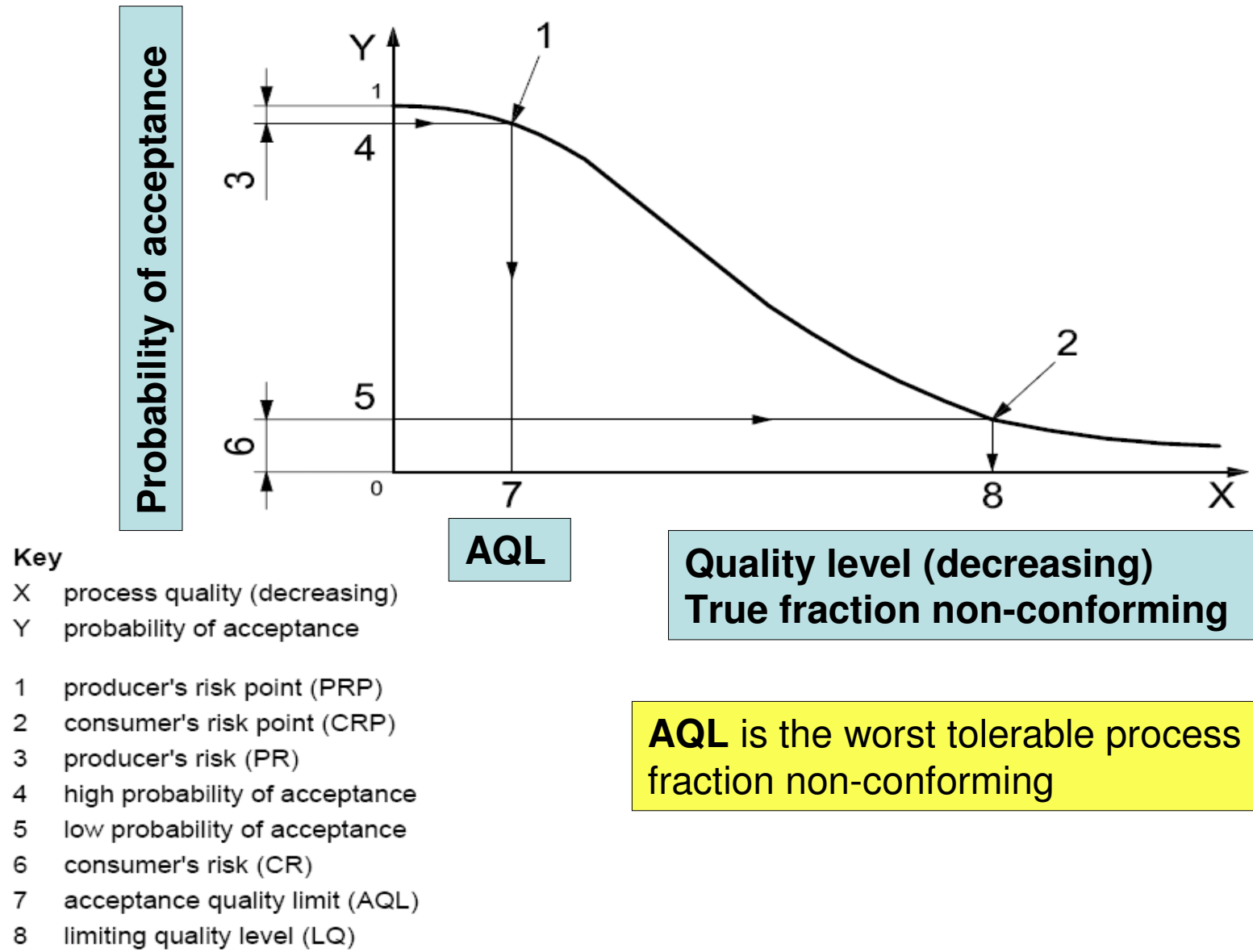
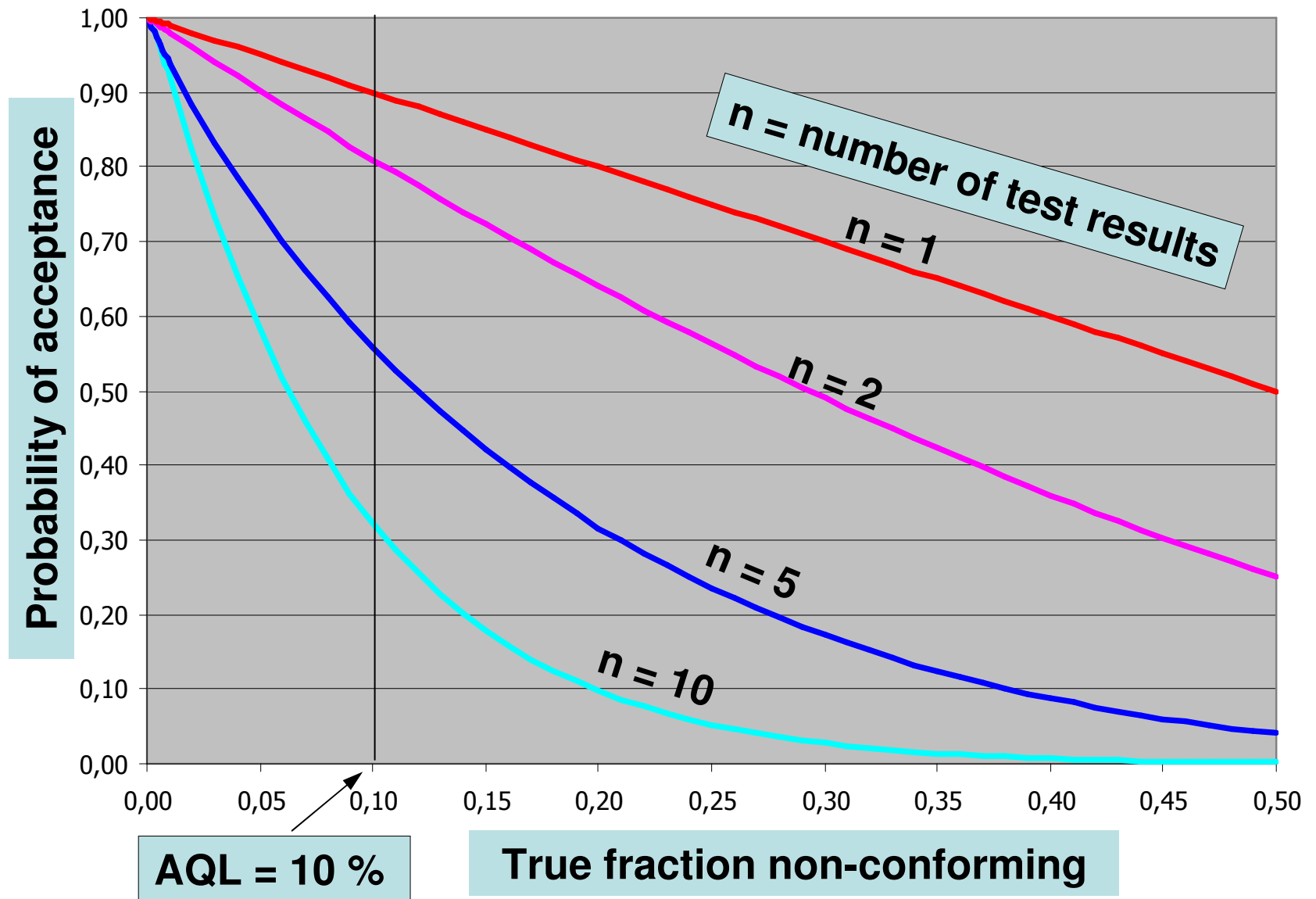


Figure 2 — Operating characteristic curve defined by acceptance quality limit (AQL) and limiting quality (LQ)

OC-curves for the single result method

None non-conforming test result is allowed

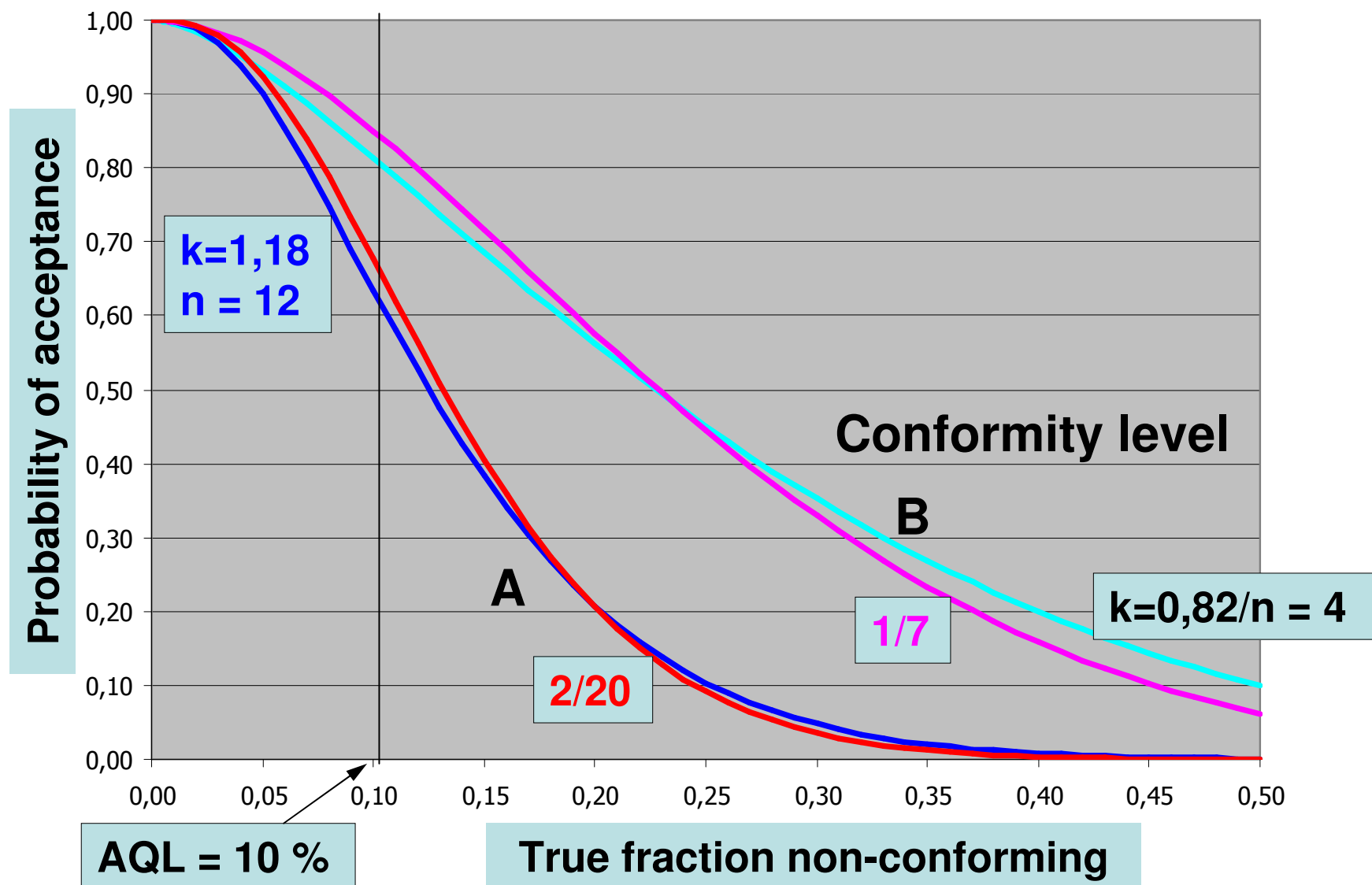


Main criteria for the statistical methods

Current draft

Conformity level	Attributes method		Variables method	
	n	n_{nc}	n	k
A	20	2	12	1,18
B	7	1	4	0,82

OC-curves for main criteria - current draft

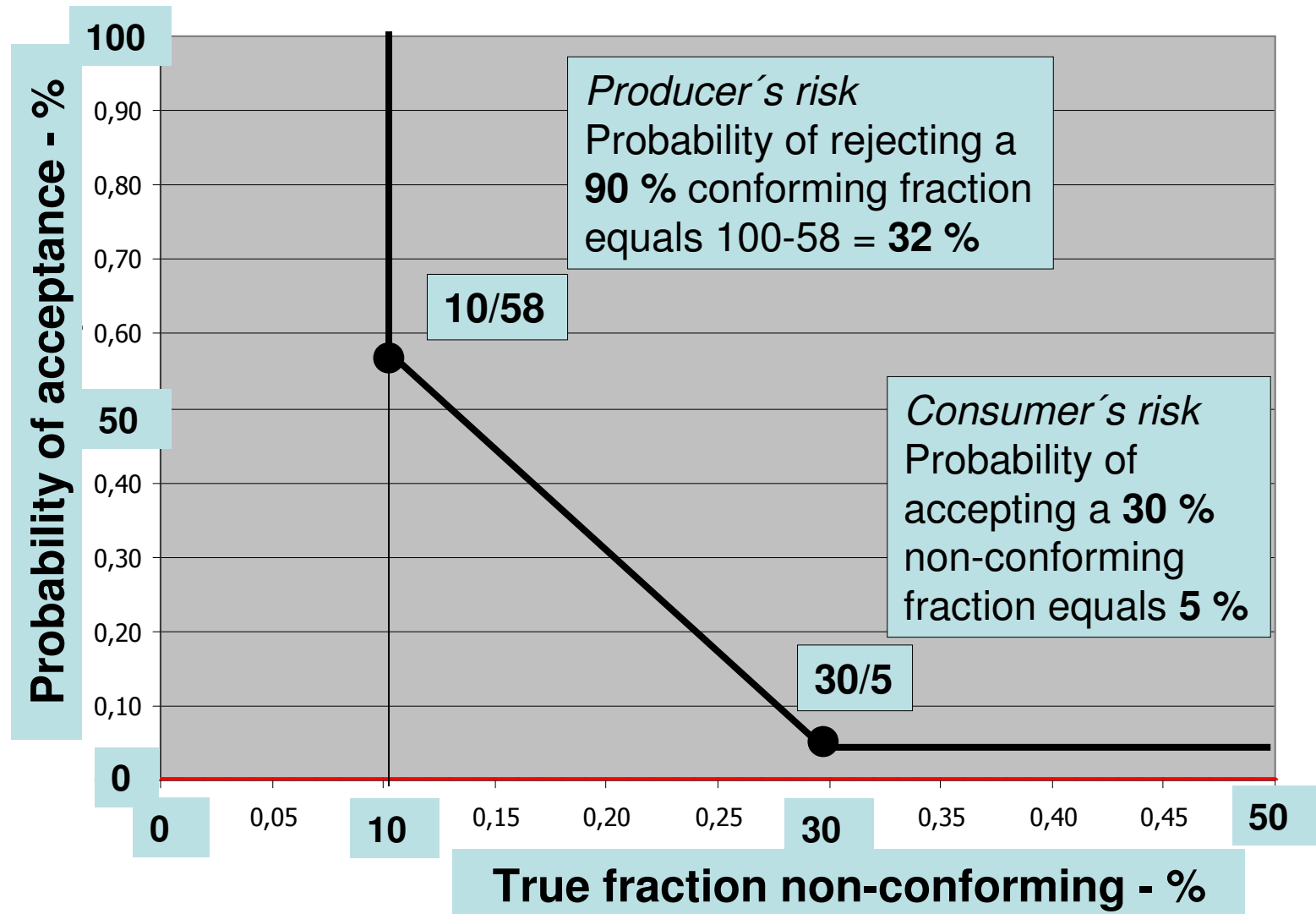


ISO Inspection by attributes and variables

Equivalent sample sizes - normal inspection

Sample size code letter	Inspection by attributes (ISO 2859-1)	Inspection by variables (ISO 3951-1; "s"-method)
A	2	-
B	3	3
C	5	4
D	8	6
E	13	9
F	20	13
G	32	18

Critical points for the OC curve of the current draft - conformity level A



Critical points for OC curves according to ISO acceptance sampling

Producer's risk point

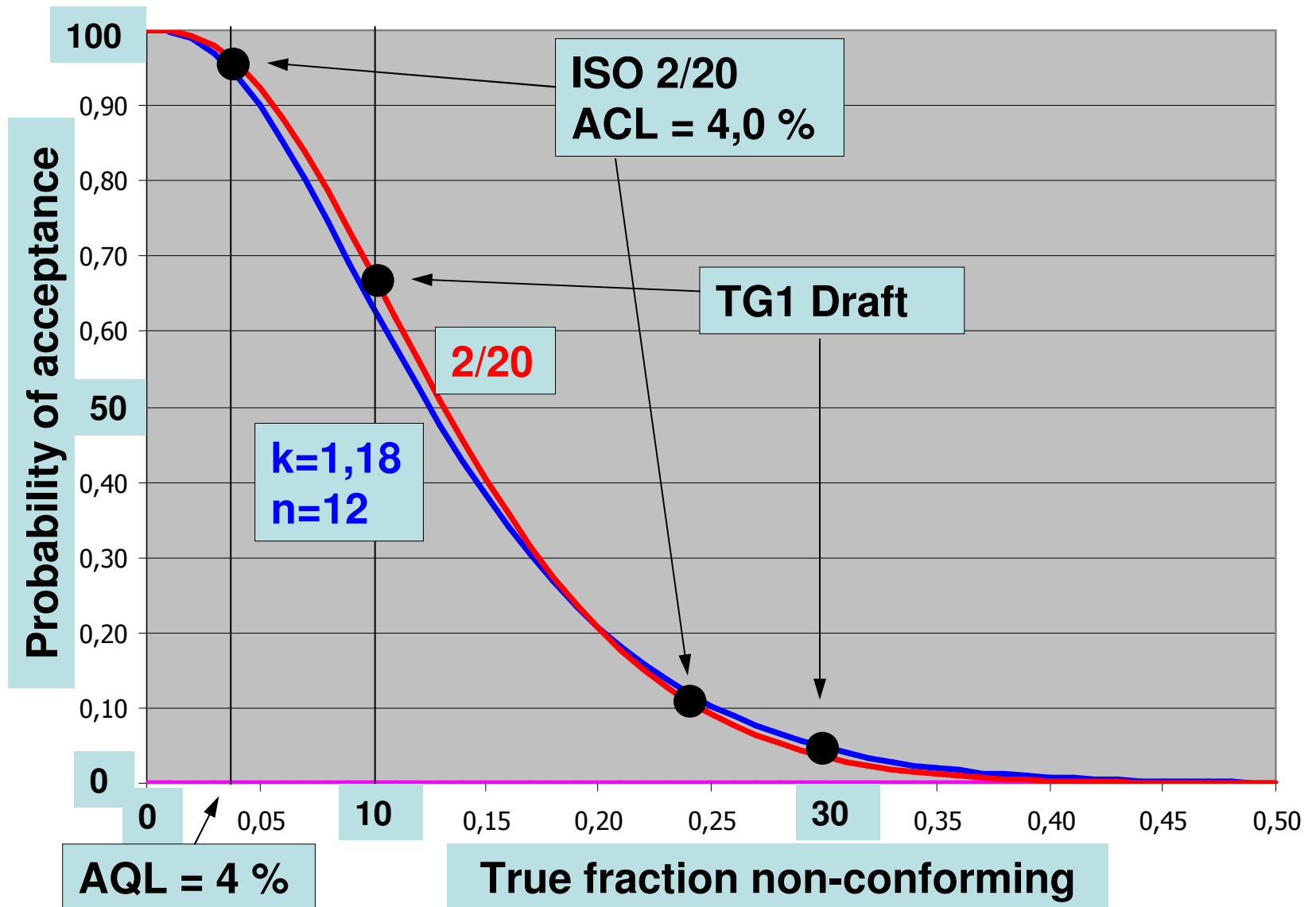
Probability of non-acceptance when the true quality level conforms to ACL. At normal inspection for $ACL = 4,5 \%$ and $ACL = 6,0 \%$ and sample sizes between 5 to 20 the probability of acceptance varies between 90 % and 96 %, i.e. the producer's risk is 10 % to 4 %.

Consumer's risk point

Fraction non-conforming with a 10 % probability of acceptance

Critical points for selected OC curves

Current criteria for conformity level A and ISO ACL = 4,0 %



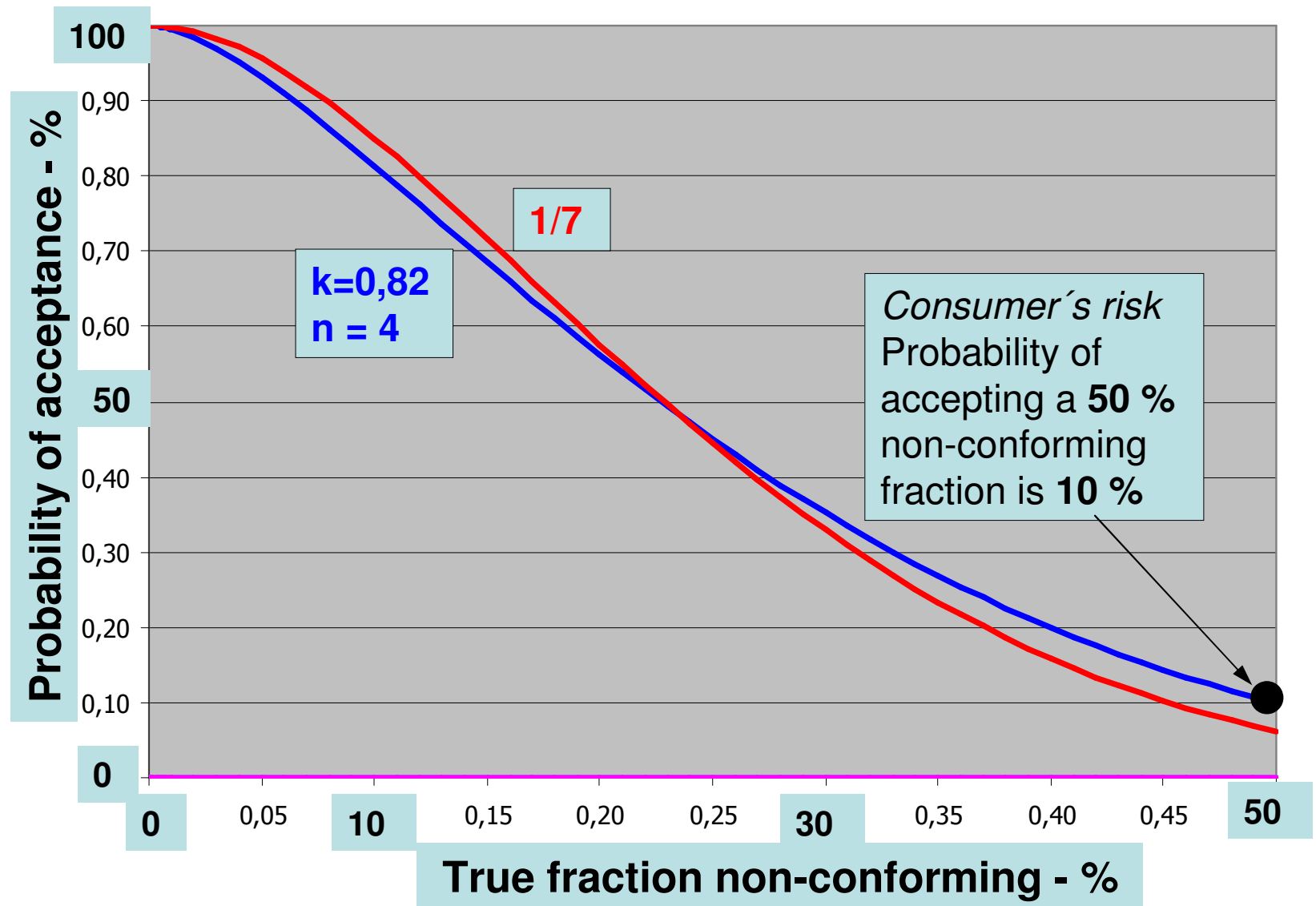
Comparison of OC curves

Criteria for conformity level A

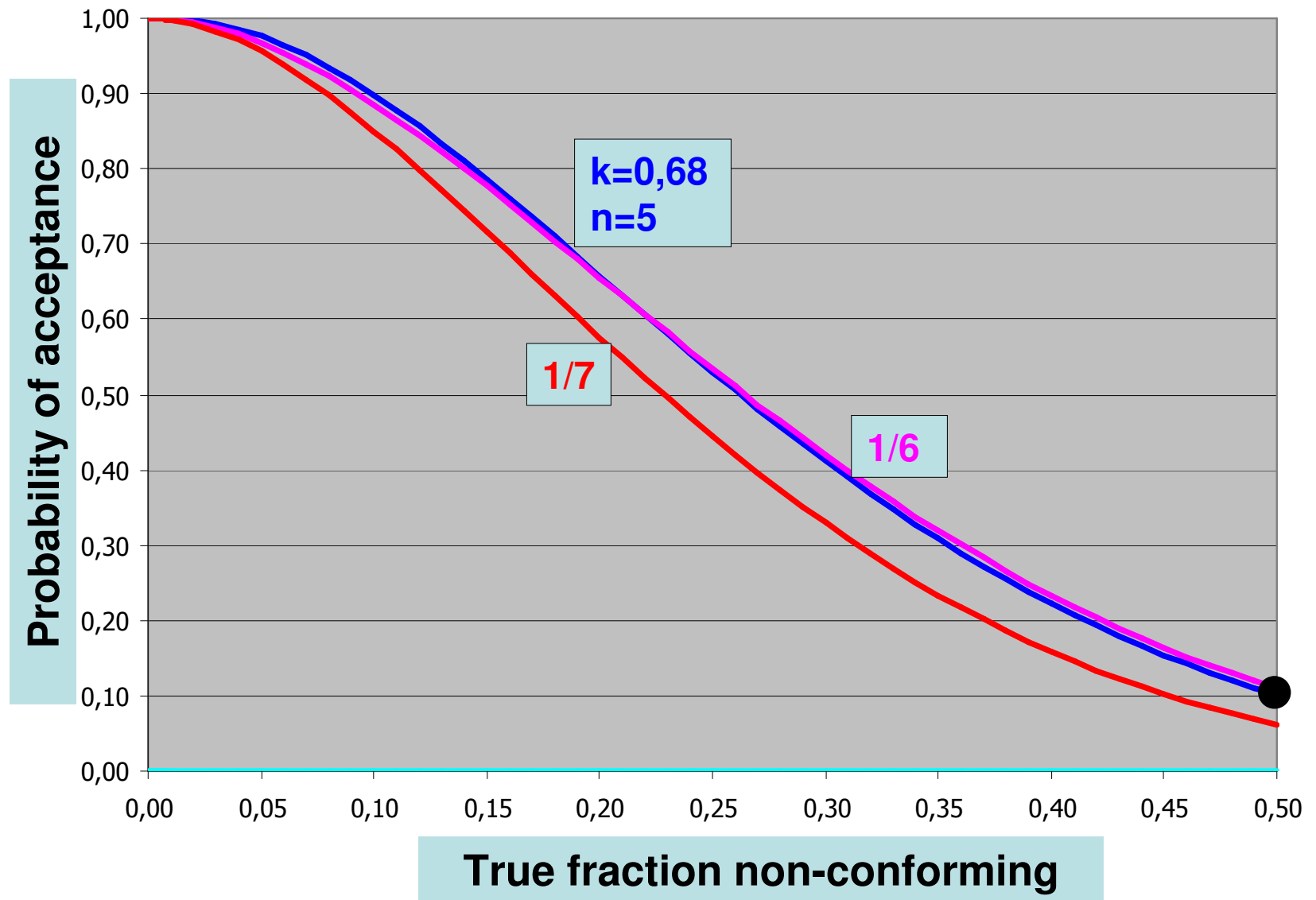
Fraction non-conforming (%)	Probability of acceptance - %		
	Attributes	Variables	
	TG1 draft and ISO $n_{nc} = 2; n = 20$	TG1 draft $k = 1,18$ $n = 12$	ISO $k = 1,19$ $n = 13$
4	96	94	94
10	68	64	63
30	4	5	4
50	0	0	0

Critical point for selected OC-curves

Current criteria for conformity level B



Alternative criteria for conformity level B



Comparison of OC curves

Criteria for conformity level B

Fraction non- conforming (%)	Probability of acceptance - %			
	TG1 draft		Alternative criteria	
	$n_{nc} = 1$ $n = 7$	$k = 0,82$ $n = 4$	$n_{nc} = 1$ $n = 6$	$k = 0,68$ $n = 5$
4	97	95	98	99
6,5	93	90	95	96
10	85	81	89	90
30	33	35	42	41
50	6	10	11	10

ISO 2859-1 Sampling procedures for inspection by attributes

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

Sample size code letter	Sample size	AQL (%) 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	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓		
B	3	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓		
C	5	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓		
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	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓		

↓ = 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

ISO 3951-1 Sampling procedures for inspection by variables

Table B.1 — Single sampling plans for normal inspection (master table): “s” method

Code letter	Sample size	Acceptance quality limit % nonconforming																	
		AQL %																	
		0,01	0,015	0,025	0,04	0,065	0,10	0,15	0,25	0,40	0,65	1,0	1,5	2,5	4,0	6,5	10,0		
		<i>k</i>	<i>k</i>	<i>k</i>	<i>k</i>	<i>k</i>	<i>k</i>	<i>k</i>	<i>k</i>	<i>k</i>	<i>k</i>	<i>k</i>	<i>k</i>	<i>k</i>	<i>k</i>	<i>k</i>	<i>k</i>		
B	3	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	0,954	0,818	0,526		
C	4	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	1,163	1,046	0,853	0,580		
D	6	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	1,395	1,275	1,108	0,902	0,587		
E	9	↓	↓	↓	↓	↓	↓	↓	↓	↓	1,615	1,494	1,338	1,159	0,907	0,597			
F	13	↓	↓	↓	↓	↓	↓	↓	↓	1,830	1,712	1,565	1,405	1,189	0,938	0,614			
G	18	↓	↓	↓	↓	↓	↓	↓	2,025	1,910	1,770	1,622	1,429	1,212	0,944	0,718			
H	25	↓	↓	↓	↓	↓	↓	2,215	2,102	1,969	1,829	1,652	1,457	1,225	1,035	0,809			
J	35	↓	↓	↓	↓	↓	2,399	2,289	2,160	2,028	1,862	1,684	1,476	1,311	1,118	0,912			
K	50	↓	↓	↓	↓	2,569	2,461	2,336	2,209	2,052	1,885	1,693	1,543	1,372	1,193	0,947			
L	70	↓	↓	↓	↓	2,736	2,631	2,510	2,389	2,239	2,082	1,904	1,766	1,611	1,451	1,238	↑		
M	95	↓	↓	↓	2,889	2,787	2,670	2,553	2,410	2,261	2,093	1,965	1,822	1,676	1,484	↑	↑		
N	125	↓	↓	3,037	2,937	2,824	2,711	2,574	2,432	2,274	2,154	2,021	1,886	1,710	↑	↑	↑		
P	160	↓	3,179	3,082	2,973	2,865	2,733	2,597	2,447	2,334	2,209	2,083	1,921	↑	↑	↑	↑		
Q	200	3,310	3,215	3,109	3,004	2,877	2,747	2,603	2,495	2,377	2,258	2,106	↑	↑	↑	↑	↑		
R	250	3,350	3,247	3,146	3,023	2,898	2,760	2,657	2,545	2,432	2,289	↑	↑	↑	↑	↑	↑		

NOTE 1 The sample-size code letters in this part of ISO 3951 correspond to those given in ISO 2859-1.

NOTE 2 Symbols: ↓ There is no suitable plan in this area; use the first sampling plan below the arrow. If the sample size equals or exceeds the lot size, carry out 100 % inspection.

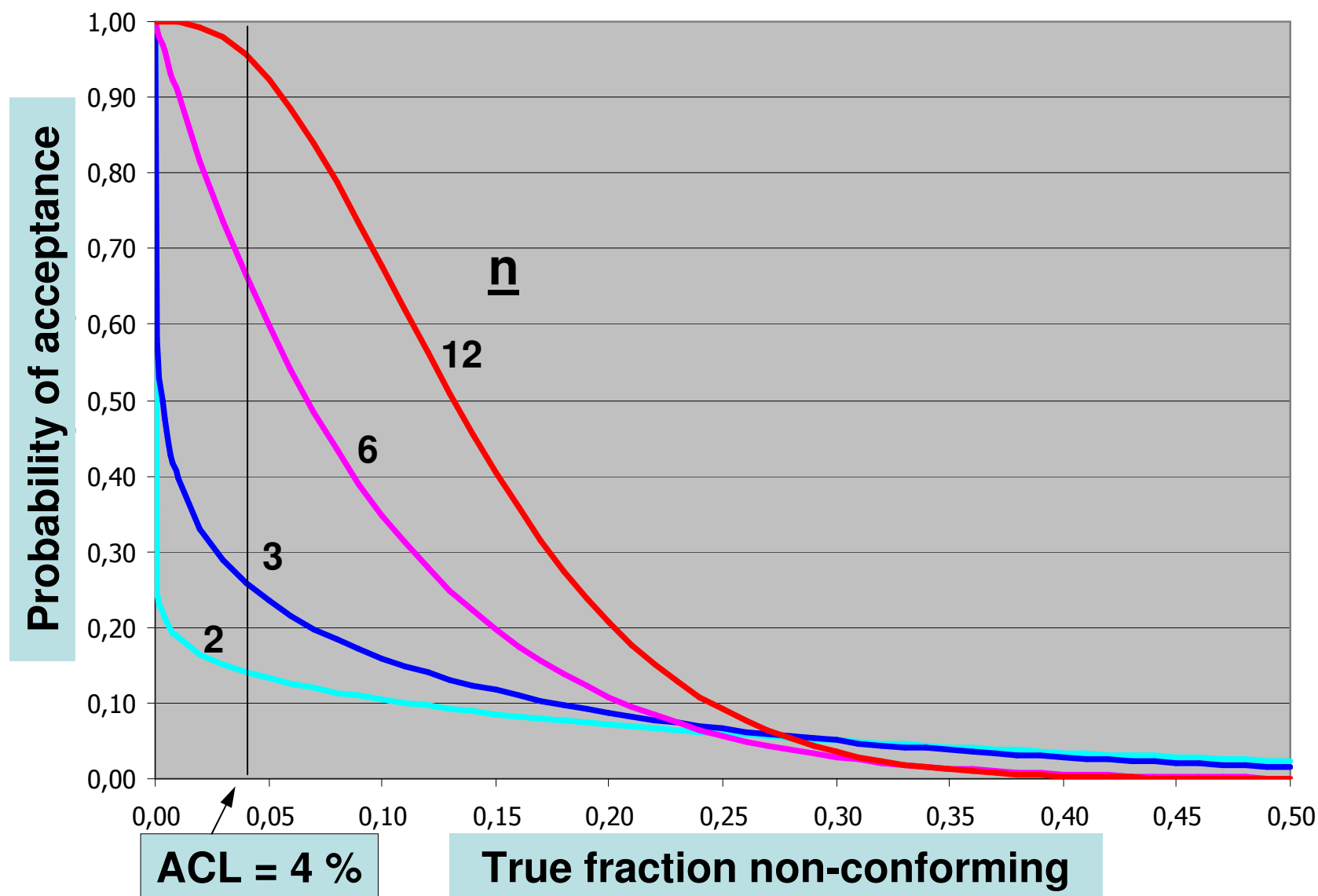
↑ There is no suitable plan in this area; use the first sampling plan above the arrow.

Inspection by variables

Number of test results (= n)	Conformity level			
	A		B	
	Current draft	Proposal ISO	Current draft	Proposal ISO
2	9,84	-	2,18	-
3	3,28	0,95	1,09	0,82
4	2,27	1,05	0,82	0,85
5	1,86	-	0,69	-
6	1,64	1,11	0,60	0,90
7	-	-	0,54	-
8	1,39	-	0,50	-
9	-	1,16	0,47	0,91
10	1,26	-	0,44	-
11	-	-	0,41	-
12	1,18	-	0,39	-
13	-	1,19	0,38	0,94

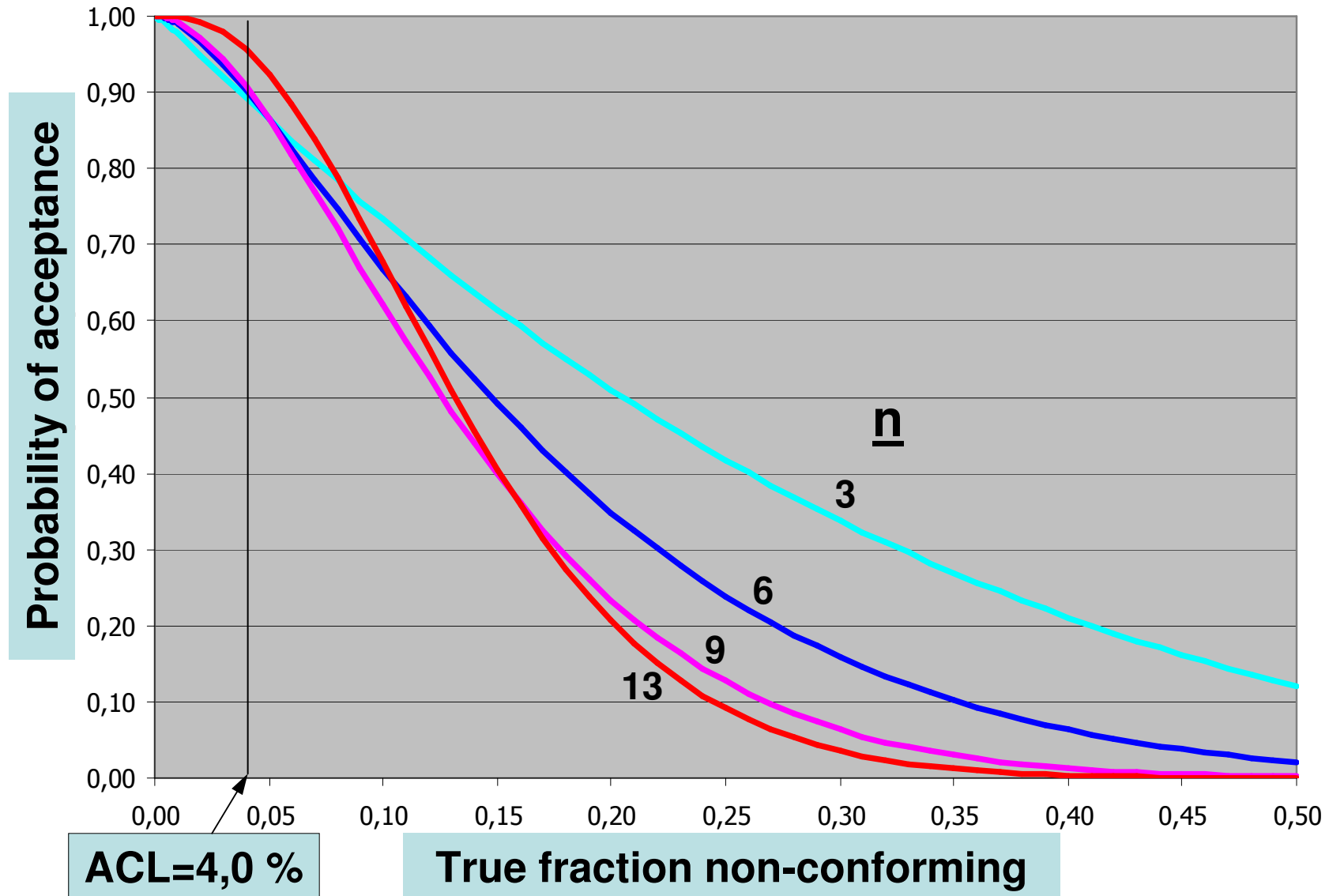
Inspection by variables

Current draft Annex C - Conformity level A



ISO 3951-1 Inspection by variables

ACL = 4,0 % ($\approx$ Conformity level A)



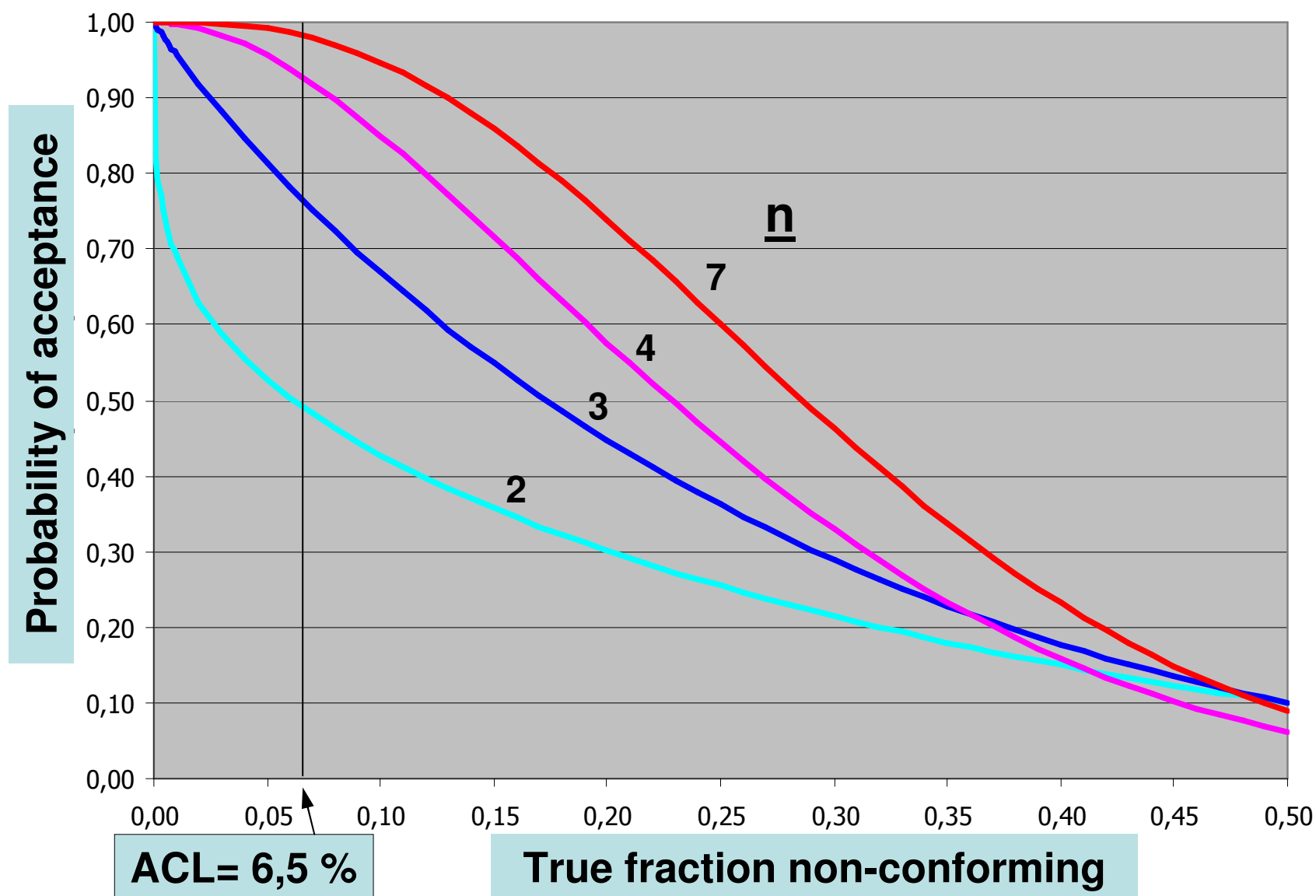
ISO 'Equivalent' criteria – normal inspection

ACL = 4 % ($\approx$ Conformity level A)

Sample size code letter	Inspection by attributes (ISO 2859-1)		Inspection by variables (ISO 3951-1)	
	Number of test results	Acceptable number of non- conforming test results	Number of test results	k
A	2	-	-	-
B	3	0	3	0,95
C	5	-	4	1,05
D	8	-	6	1,11
E	13	1	9	1,16
F	20	2	13	1,19
G	32	3	18	1,21

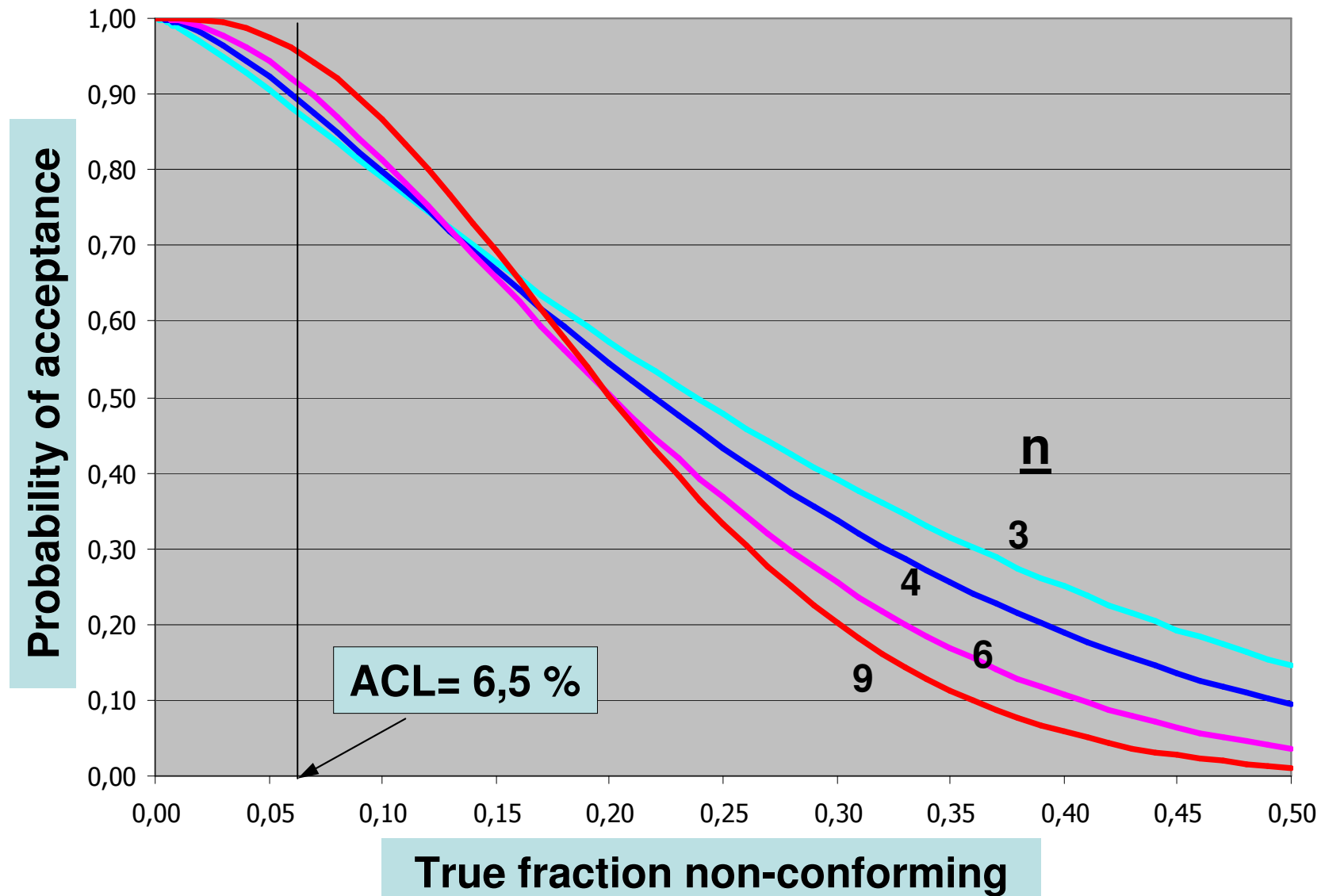
Inspection by variables

Current draft Annex C - Conformity level B



ISO 3951-1 Inspection by variables

ACL = 6,5 % ($\approx$ Conformity level B)



Inspection by attributes

Number of test results (= n)	Conformity level			
	A		B	
	Current draft	Proposal ISO	Current draft	Proposal ISO
2	-	-	-	0
4	-	-	0	-
7	-	-	1	-
8	-	0	-	1
9	0	-	2	-
12	-	-	3	-
13	-	1	-	2
14	1	-	4	-
17	-	-	5	-
19	-	-	6	-
20	2	2	-	3

ISO 3951-2

Inspection by variables

