

 **Çolakoğlu** Metalurji

DOKÜMAN KODU	KK.296
DOKÜMAN ADI	Decision Rule Work Instructions
REVİZYON NO	2
REVİZYON TARİHİ	06.09.2023
BÖLÜM / YER	Quality Metallurgy and R&D Department
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1. OBJECTIVE

The purpose of this instruction is to evaluate the results of the analysis according to the standard, legislation or a specification, if requested, and to determine the tolerance ranges and conformity.

2. SCOPE

The scope of this instruction is the steps and processes to be applied upon the request of the evaluation of the analysis results performed in the Çolakoğlu Metalurji A.Ş Chemistry laboratory according to the standard, legislation or a specification.

3. RESPONSIBILITY

Steel Production and Continuous Castings Quality & Process Control Experts and Assistant Experts are responsible for the preparation and up-to-date of this instruction. Quality Metallurgy and R&D Manager, Steel Production and Continuous Castings Quality & Process Control Supervisor, Experts and Assistant Experts, Team Leaders, Chargehand and Workers are responsible for its implementation.

4. DEFINITIONS and ABBREVIATIONS

OHS; Occupational health and Safety

Occupational Safety Area Responsibilities; It specifies the persons defined by ensuring the implementation of the Occupational Safety rules determined in the section, monitoring and coordinating with the OHS Unit.

Declaration of Conformity: Evaluation of conformity against a standard or specification or regulation.

Decision Rule: A rule that explains how to account for measurement uncertainty when specifying compliance with a specified requirement.

Requirement: When the client requests a declaration of conformity against a standard or regulation or specification for analysis, the standard or regulation or specification and the decision rule chosen should be clearly defined.

Measurement Uncertainty: It is related to the measurement results and shows the distribution of the values depending on the measurement.

Extended Measurement Uncertainty: It is the uncertainty obtained by multiplying the composite standard uncertainty by the confidence coefficient.

Acceptance Area: It is the area where the measured property of a product falls within the specified reference value according to the decision making rule.

Rejection Area: It is the area where the measured property of a product falls outside the specified reference value according to the decision making rule.

Protection Range (Area-Zone): It is the boundary region between the acceptance and rejection areas. This range is generally determined by the measurement uncertainty in practice.

Type 1 Error (α): It is the probability that the tested sample will be considered as pass although the obtained measurement result is not suitable (FN).

FN=False Negative =Type 1 error so α = False Rejection = False Rejection (Reduced Producer Risk)

Type 2 Error (β): The probability (FP) that the tested sample is considered to be residual although the obtained measurement result is favorable.

FP=False Positive = Type 2 error so β =False Acceptance=False Acceptance (Reduced Consumer Risk)

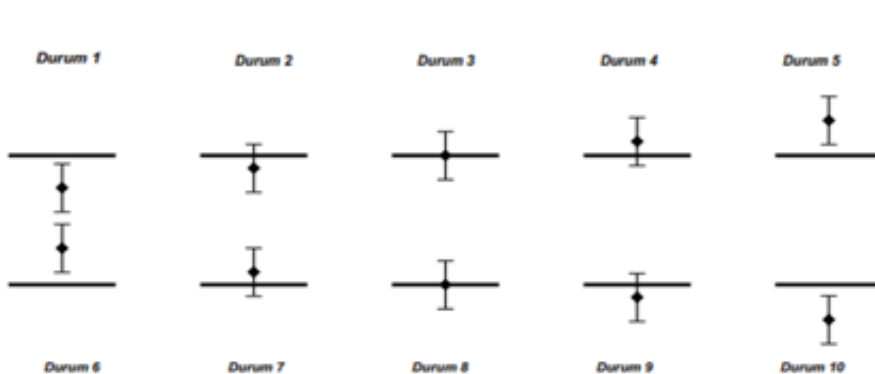
Producer (Supplier) Risk: Creating a reprocessing or scrapping cost by making a negative evaluation of a suitable product.

Consumer (Consumer) Risk: Sending the product to the consumer by making a positive evaluation of an inappropriate product and being exposed to a penal clause.

Simple Acceptance: The acceptance rule where the acceptance limit is the same as the tolerance limit (not including measurement uncertainty)

5. APPLICATION

5.1 There are several possible situations in which uncertainty affects the reporting of the evaluation of analysis results, and these are as follows:



Measurement Result By The Agreed Method

I=Uncertainty Range By Agreed Method

Figure 1: Cases related to the decision rule

A decision of eligibility for cases 1 and 6 and non-compliance for cases 5 and 10 can be easily made. However, for Cases 2,3,4,7,8 and 9, the Decision Rule needs to be determined to grant eligibility and non-compliance.

If the product or analysis standard requires declaration of conformity in the laboratory report, but does not provide any information on the effects of confidence level and measurement uncertainty in the assessment of conformity in the relevant standards, the laboratory does not consider the confidence level and the measurement uncertainty, based solely on whether the result obtained is within specified limits or assess the non-compliance.

This is often referred to as shared risk because the end user takes some risk; that is, the product may not meet specification after testing with an agreed measurement method. In this case, there is an implicit assumption that the uncertainty of the agreed measurement method is acceptable and can be calculated if necessary. Relevant legislation or legal requirements may override the shared risk principle and place the risk of uncertainty on a party.

If legal requirements require a declaration of conformity or non-compliance regardless of the level of confidence, the notification must be made according to the limit (criterion) specified by the legislation:

(i) If the limit is defined as “<” or “>” and the analysis result is equal to the limit, the non-conformance is indicated,

(ii) If the limit is defined as “≤” or “≥” and the analysis result is equal to the limit, compliance is stated.

In case of maximum (maximum) and minimum (least) expressions, they are evaluated under the same conditions as (ii).

5.2 If it is not specified in the analysis standard or legal regulations or specifications, or if a declaration of conformity is not requested in the request letters sent by the customer, a declaration of conformity will not be given. The following expressions will be used when submitting the Declaration of Conformity.

- Eligibility=Positive
- Discord = Negative

If a decision rule regarding the issuance of the declaration of conformity is not defined in the analysis standard or in the legal regulations or specifications and a declaration of conformity is requested by the customer, the following information should be provided by the customer. (The Procedure for Reviewing Laboratory Requests, Proposals and Contracts)

- Request for Declaration of Conformity
- Specification specifying lower and/or upper limits (Standard/Legislation/Specification)
- Decision Rule (One of the following can be selected)

Measurement Uncertainty Will Be Included.

□ Measurement Uncertainty Will Not Be Included.

() False Reject

() False Accept

(Simple Accept)

Unless otherwise requested by the customer, the guard tape method will be used. While calculating the guard band, the standard uncertainty (68% confidence interval $k=1$) will be calculated by multiplying the one-way k value. The one-way k value is 1.64 at the 95% confidence interval. Where the sample is taken by the customer, data that excludes the measurement uncertainty from sampling shall be used. Sampling is not performed in our laboratory. Measurement uncertainties are calculated according to the Laboratory Measurement Uncertainty Evaluation Procedure.

If a declaration of conformity is requested by the customer, but the decision rule is not specified in the product/analysis standard or legal regulations or specifications, or if it is not chosen by the customer; Çolakoğlu Metallurgical Chemistry Laboratory Laboratory has chosen to make a decision without including the measurement uncertainty (Simple Acceptance) while evaluating the suitability. If the customers do not specify the decision rule in their requests, they are deemed to have accepted this condition.

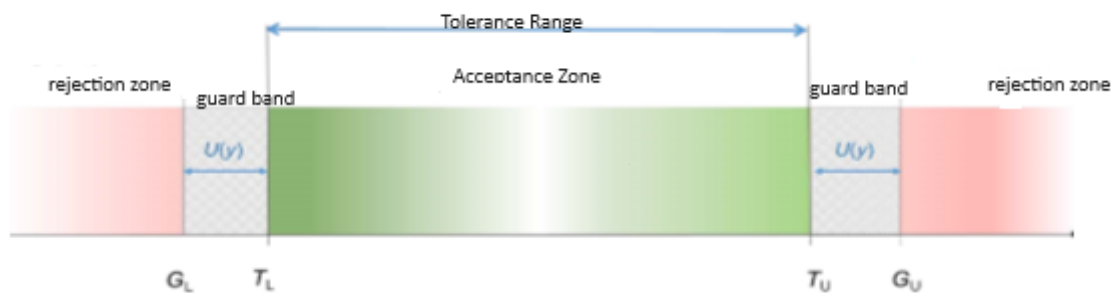


Figure 2-Acceptance and Rejection Zone Based on Lower and Upper Limits (False Rejection)



Figure 3- Acceptance and Rejection Zone Based on Lower and Upper Limits (False Acceptance)

5.3 Examples

5.3.1 Protection Band Based on Low Limit-False Rejection

Minimum limit value 180°The value found in the sample according to the specification C is 177°At C and k=2 and 95% Confidence Interval, the expanded uncertainty is 2.2%. Calculated guard band 3.2°C and the new lower acceptance limit calculated according to the “False Rejection” rule is 176.8 °C , and since the result is within this range, the SUITABLE result is given.

Protection Band Based on Low Limit-False Rejection					
x	:	177	°C	Measured value	
LowerLimit	:	180	°C	Lower Limit	
U	:	3.9	°C	95%CI	
u	:	1.95	°C	68% CI	
k	:	1.64	°C	Single Ended	
Guard band	:	3.2	°C		
New Lower Acceptance Limit	:	176.8	°C		CI %
Evaluation	:	SUITABILITY			95

Table 1: Protection Tape Based on Lower Limit-False Rejection

5.3.2 Protection Band Based on Lower Limit-Misacceptance

According to the specification with a minimum limit value of 180 °C , the value found in the sample is 184 °C and the expanded uncertainty at k=2 and 95% Confidence Interval is 2.2%. The calculated protection band is 3.33 °C , and the new lower acceptance limit calculated according to the “False Acceptance” rule is 183.3 °C , and the CONFORMITY result is given because the result is within this range.

Protection Band Based on Lower Limit-Misacceptance					
x	:	184.0	°C	Measured value	
LowerLimit	:	180.0	°C	Lower Limit	
U	:	4.0	°C	95%CI	

u	:	2.02	°C	68% CI	
k	:	1.64	°C	Single Ended	
Guard band	:	3.33	°C		
New Lower Acceptance Limit	:	183.3	°C		CI %
Evaluation	:	SUITABILITY			95

Table 2: Protection Tape Based on Lower Limit-Incorrect Acceptance

5.3.3 Protection Band Based on Upper Limit-False Rejection

According to the TAN specification with a maximum limit value of 0.100 mgKOH/g, the value found in the sample is 0.105 mgKOH/g and the expanded uncertainty at k=2 and 95% Confidence Interval is 8.5%. The calculated protection band is 0.007 mgKOH/g, and the new upper acceptance limit calculated according to the “False Rejection” rule is 0.107 mgKOH/g, and since the result is within this range, the SUITABLE result is given.

Protection Band Based on Upper Limit-False Rejection					
x	:	0.105	mgKOH/g	Measured value	
UpperLimit	:	0.100	mgKOH/g	Upper limit	
U	:	0.009	mgKOH/g	95%CI	
u	:	0.004	mgKOH/g	68% CI	
k	:	1.64		Single Ended	
Guard band	:	0.007	mgKOH/g		
New Upper Acceptance Limit	:	0.107	mgKOH/g		CI %
Evaluation	:	SUITABILITY			95

Table 3: Protection Tape Based on Upper Limit-False Rejection

5.3.4 Protection Tape Based on Upper Limit-Misacceptance

According to the specification with a maximum limit value of 0.100 mgKOH/g, the value found in the sample is 0.092 mgKOH/g, and the expanded uncertainty at k=2 and 95% Confidence Interval is 8.5%. The calculated protection band is 0.006 mgKOH/g, and the new upper acceptance limit calculated according to the “False Acceptance” rule is 0.094 mgKOH/g, and the COMPATIBILITY result is given because the result is within this range.

Protection Tape Based on Upper Limit-Misacceptance					
x	:	0.092	mgKOH/g	Measured value	
UpperLimit	:	0.100	mgKOH/g	Upper limit	
U	:	0.008	mgKOH/g	95%CI	
u	:	0.004	mgKOH/g	68% CI	
k	:	1.64		Single Ended	
Guard band	:	0.006	mgKOH/g		
New Upper Acceptance Limit	:	0.094	mgKOH/g		CI %
Evaluation	:	SUITABILITY			95

Table 4: Protection Tape Based on Upper Limit-False Acceptance

5.3.5 Protection Tape Based On A Tolerance Range-Misacceptance

According to the specification with Minimum Limit Value of 12.50 mm²/s and Maximum limit value of 16.3 mm²/s, the value found in the sample is 12.60 mm²/s and the expanded uncertainty at k=2 and 95% Confidence Interval is 0.66%. The calculated protection band is 0.07 mm²/s, and the new lower acceptance limit calculated according to the “False Acceptance” rule is 12.57 mm²/s and the upper acceptance limit is 16.23 mm²/s. Since the result is within this range, the CONFORMITY result is given.

Protection Tape Based On A Tolerance Range-Misacceptance					
x	:	12.60	mm ² /s	Measured value	
LowerLimit	:	12.50	mm ² /s	Lower Limit	

UpperLimit	:	16.30	mm ² /s	Upper limit	
U	:	0.08	mm ² /s	95%CI	
u	:	0.04	mm ² /s	68% CI	
k	:	1.64		Single Ended	
Guard band	:	0.07	mm ² /s		
New Lower Acceptance Limit	:	12.57	mm ² /s		
New Upper Acceptance Limit	:	16.23	mm ² /s		
					CI %
Evaluation	:	SUITABILITY			95

Table 5: Protection tape based on a tolerance range-incorrect acceptance

5.3.6 Guard Tape Based On A Tolerance Range-False Rejection

According to the specification with Minimum Limit Value of 12.50 mm²/s and Maximum limit value of 16.3 mm²/s, the value found in the sample is 12.44 mm²/s and the expanded uncertainty at k=2 and 95% Confidence Interval is 0.66%. The calculated protection band is 0.07 mm²/s, and the new lower acceptance limit calculated according to the “False Rejection” rule is 12.43 mm²/s and the upper acceptance limit is 16.37 mm²/s. Since the result is within this range, the SUITABLE result is given.

Guard Tape Based On A Tolerance Range-False Rejection					
x	:	12.44	mm ² /s	Measured value	
LowerLimit	:	12.50	mm ² /s	Lower Limit	
UpperLimit	:	16.30	mm ² /s	Upper limit	
U	:	0.08	mm ² /s	95%CI	

u	:	0.04	mm ² /s	68% CI	
k	:	1.64		Single Ended	
Guard band	:	0.07	mm ² /s		
New Lower Acceptance Limit	:	12.43	mm ² /s		
New Upper Acceptance Limit	:	16.37	mm ² /s		
					CI %
Evaluation	:	SUITABILITY			95

Table 6: Protection tape based on a tolerance range-false rejection

5.3.7 Without Including a Lower Limit-Measurement Uncertainty

Minimum limit value 180°The value found in the sample according to the specification C is 179°Extended uncertainty at C and k=2 and 95% Confidence Interval 3.9°is C. According to the rule "Measurement Uncertainty Will Not Be Included", the result of DISABILITY is given because the result is outside this range.

Without Including a Lower Limit-Measurement Uncertainty					
x	:	179	°C	Measured value	
LowerLimit	:	180	°C	Lower Limit	
U	:	3.9	°C	95%CI	
u	:	1.97	°C	68% CI	
Evaluation	:	NON-COMPLIANCE			

Table 7: Without Including a Lower Limit-Measurement Uncertainty

5.3.8 Without Including an Upper Limit-Measurement Uncertainty

According to the specification with a maximum limit value of 0.100 mgKOH/g, the value found in the sample is 0.095 mgKOH/g and the expanded uncertainty at k=2 and 95%

Confidence Interval is 0.008 mgKOH/g. According to the "Measurement Uncertainty Will Not Be Included" rule, the SUITABILITY result is given because the result is within this range.

Without Including an Upper Limit-Measurement Uncertainty				
x	:	0.095	mgKOH/kg	Measured value
UpperLimit	:	0.100	mgKOH/kg	Upper limit
U	:	0.008	mgKOH/kg	95%CI
u	:	0.004	mgKOH/kg	68% CI
Evaluation	:	SUITABILITY		

Table 8 : Without Including an Upper Limit-Measurement Uncertainty

5.3.9 A Tolerance Range – Without Measurement Uncertainty

The value found according to the specification with the Minimum limit value of 12.50 mm2/s and the Maximum limit value of 16.30 mm2/s is 12.54 mm2/s and the expanded uncertainty at k=2 and 95% Confidence Interval is 0.08 mm2/s. According to the "Measurement Uncertainty Will Not Be Included" rule, it gives a SUITABLE result because the result is within this range.

A Tolerance Range - Without Include Measurement Uncertainty				
x	:	12.54	mm2/s	Measured value
LowerLimit	:	12.50	mm2/s	Lower Limit
UpperLimit	:	16.30	mm2/s	Upper limit
U	:	0.08	mm2/s	95%CI
u	:	0.04	mm2/s	68% CI
Evaluation	:	SUITABILITY		

Table 9: A Tolerance Range - Without Include Measurement Uncertainty

A Tolerance Range - Without Include Measurement Uncertainty					
x	:	12.48	mm ² /s	Measured value	
LowerLimit	:	12.50	mm ² /s	Lower Limit	
UpperLimit	:	16.30	mm ² /s	Lower Limit	
U	:	0.08	mm ² /s	95%CI	
u	:	0.04	mm ² /s	68% CI	
Evaluation	:	NON-COMPLIANCE			

Table 10: A Tolerance Range - Without Include Measurement Uncertainty

5.4 Conformity Assessment for Qualitative Analysis

In the case of qualitative results specified in the standard method, SUITABILITY is given, and if not, INCOMPATIBILITY is evaluated.

5.5 Records and calculations related to Conformity Assessment are kept with the Conformity Assessment Form.

5.6 In the relevant work instruction; Laboratory Request Proposals and Review of Contracts Work Instruction (KK.298), Laboratory Measurement Uncertainty Evaluation Work Instruction (KK.306), Guide to ILAC G8 Decision Rules and Declarations of Conformity, EUROLAB Technical Report No.1-2017, ISO/IEC GUIDE 98-4 Uncertainty of measurement — Part 4: Role of measurement uncertainty in conformity assessment, EURACEM / CITAC Guide Use of uncertainty information in compliance assessment documents are referenced.

6. SAFETY CRITERIA

6.1 Personal Protective Equipment suitable for the nature of the work will be used completely and correctly.

6.2 The distance from the computer screen depends on the image, screen resolution, readability of the texts and the size of the monitor. On average, the eye-screen distance should be at least the arm distance (60-70 cm).

6.3 It should be ensured that the light does not come from the opposite side, that is, over the computer.

6.4 The top of the screen should be lower than your eye level.

6.5 The tilt angle of the monitor should be changed to avoid reflections falling on the screen.

6.6 Very small characters should not be used on the screen.

- 6.7** The screen contrast should be adjusted so as not to tire the eyes.
- 6.8** Eyes should be separated from the screen at 20-minute intervals and f°C used on a distant point, 10-15 seconds. Eyes should be closed and rested.
- 6.9** Frequent blinking should be done.
- 6.10** Care should be taken to keep the screen clean.
- 6.11** Only 2 fingers should not be used while writing.
- 6.12** There should be enough space in front of the keyboard.
- 6.13** For correct hand-mouse placement, the keyboard and mouse must be at the same height.
- 6.14** The mouse should be next to the keyboard.
- 6.15** The wrist should be kept in a straight line.
- 6.16** When using the mouse, be careful not to bend the wrist to the right or left.
- 6.17** Up and down rotation of the hand and palm should not be made excessively.
- 6.18** The keyboard, mouse, writing and reading area should be within the drawn arc without lifting the elbow from the table, while the elbows are close to the body and the hands are outstretched. (arm circle)
- 6.19** The feet should be flat on the ground, the knee should be angled at 90 degrees, the chair should be the part that supports the waist, the back should be straight, the shoulders should be relaxed, the elbows should be angled at 90 degrees and the wrists should be kept in a neutral position.
- 6.20** The chair should be able to go back and forth, swivel 360 degrees, adjustable in height, support waist tilt, adjustable back support, sitting surface should not put pressure on hips from the side.
- 6.21** The person should be able to reach all areas easily and his/her body should not be bent and twisted at the same time.

7. ENVIRONMENTAL CRITERIA

- 7.1** During the work, it is necessary to take the necessary precautions for the environmental safety and waste management for the area where the work will be done. Appropriate waste bins should be provided to separate the wastes that may occur before the field work.
- 7.2** It is ensured that the SDS forms used during the study are kept complete and up-to-date from the area where the chemicals are used and stored.
- 7.3** Gloves, rags, overalls, etc. that may occur during work. It should be ensured that the wastes are disposed of in hazardous waste bins, which are defined in a way that prevents contact with soil and water.
- 7.4** Packaging wastes (paper-cardboard, nylon, plastic, etc.) that may arise during operation should be collected and disposed of in appropriate waste bins.

7.5 Chemical wastes that will occur during the work should be collected separately in suitable containers and sent as hazardous waste.

7.6 The fume hood should be operated continuously for emissions caused by the use of acids and bases that may occur during operation.

7.7 For scrap materials that may occur during operation, the rules in the PRO 380 Procedure Regarding the Principles to be Followed in the Repair, Scrapping, Sale or Disposal of Materials must be followed.

7.8 As a result of all these studies, the Sustainability and Environment Directorate is informed about the appropriate Recovery/Disposal of the wastes collected in accordance with their class.