Technical Delivery Regulation

W03 – Process Workflow

Hirschmann Automotive GmbH
Oberer Paspelsweg 6-8, 6830 Rankweil

T +43(0)5522 307-0 F +43(0)5522 307-553
info@hirschmann-automotive.com, www.hirschmann-automotive.com

This standard governs the requirements for documentation and the general regulations for the delivery of systems.

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This delivery regulation W03 replaces all previous regulations.

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W01	-	Created by: Gaiser Michael	05.09.2019
W02	Complete	Reworked by: Gaiser Michael	19.05.2021
W03	Complete	Wording from Hirschmann to Hirschmann Automotive	15.06.2022

Person responsible:	Wittmann Ralph
Department:	P_PTP.RW

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1. General

1.1. Scope

This Hirschmann Automotive factory standard outlines the delivery regulations for fully automatic and semi-automatic systems.
Semi-automatic systems may show minor deviations from fully automatic systems.

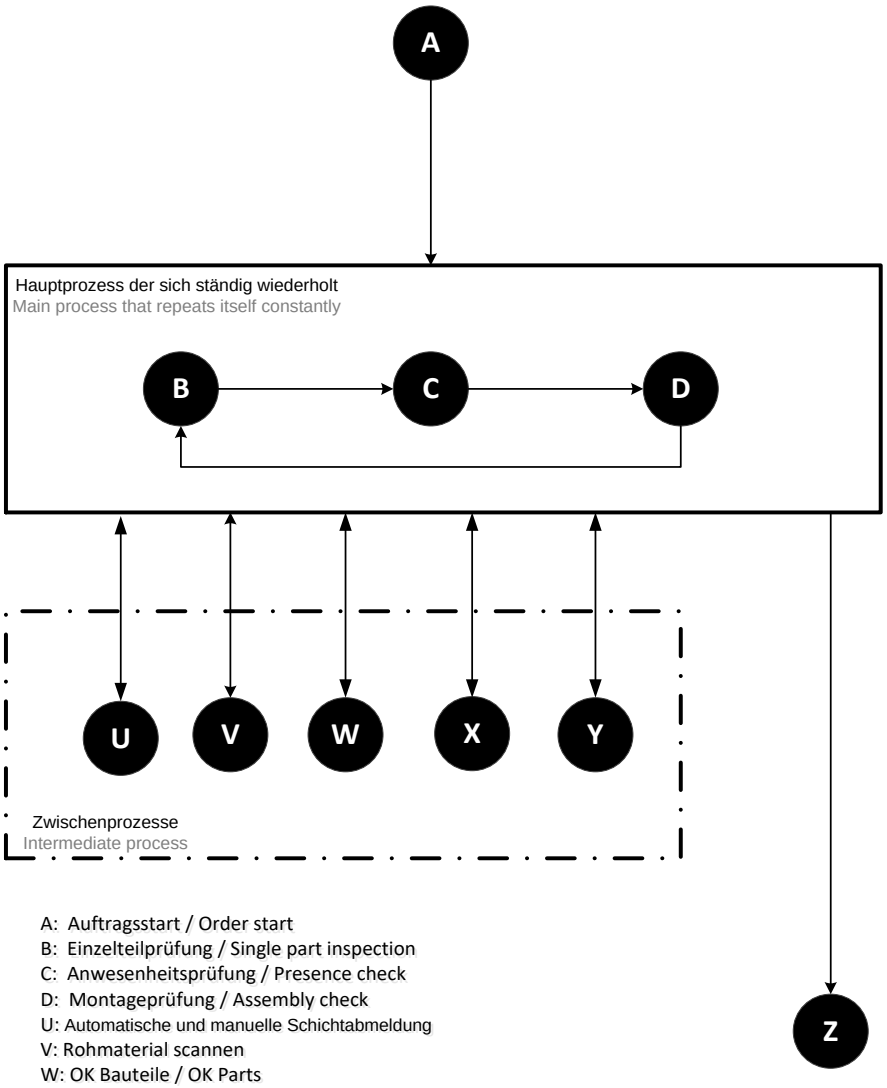
1.2. Deviations

Deviations from this delivery specification, which may appear necessary or appropriate to the manufacturer, require written approval from Hirschmann Automotive.

2. System Control Behaviour

The following graphics illustrate the handling and behaviour of the system.
These are divided into:

- Production start (A).
- Production (B, C, D).
- Intermediate processes (U, V, W, X, Y).
- Production end (Z).

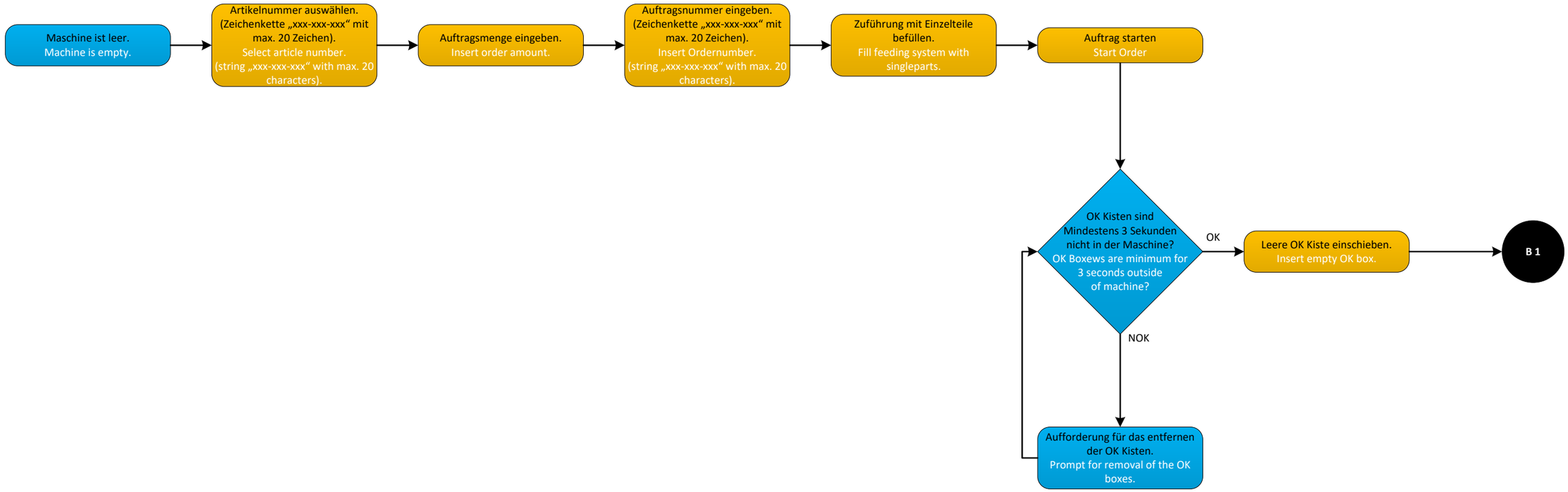


2.1. Colour Codes

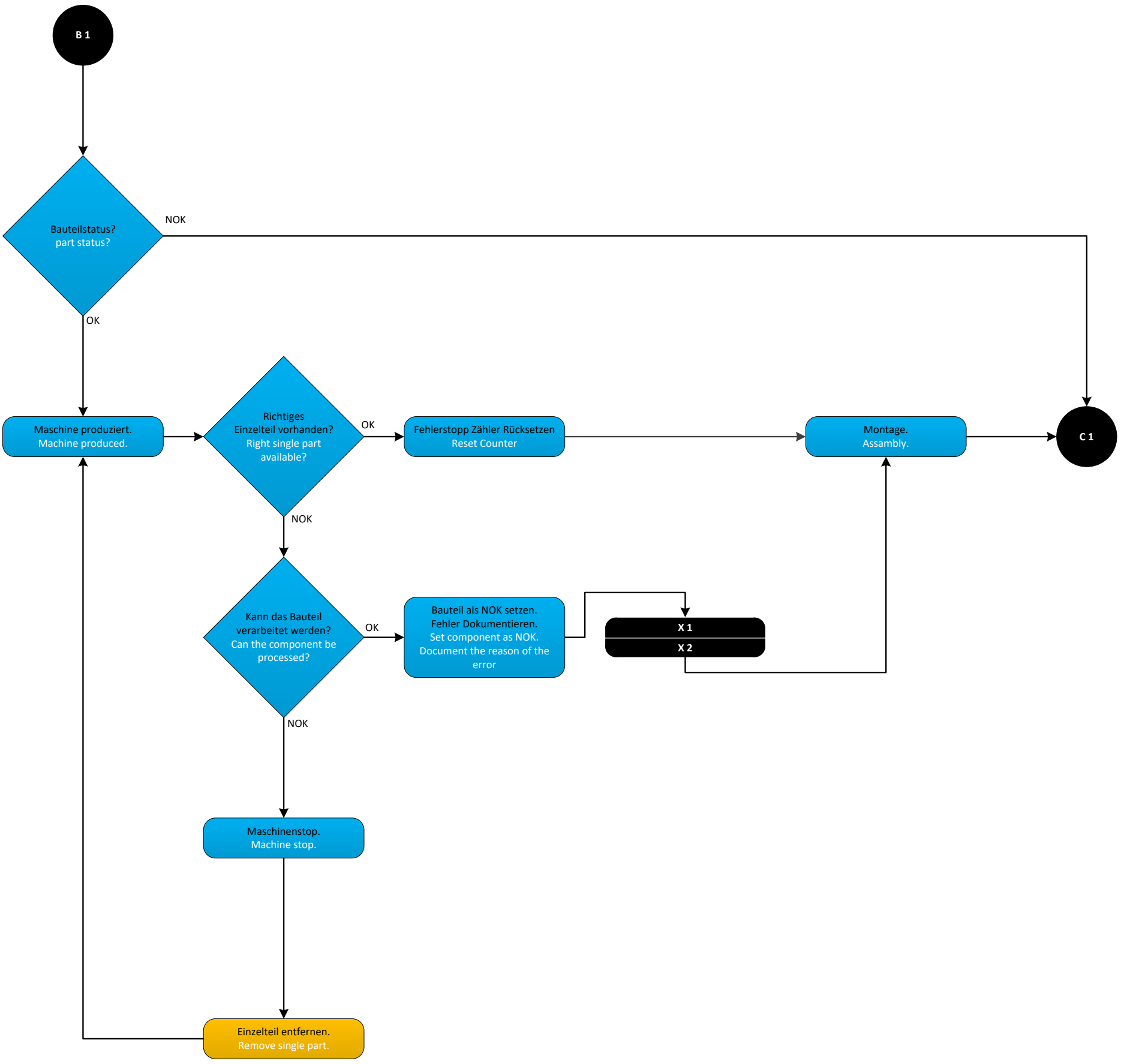
The colours in the flowcharts A to Z have the following meanings:

Orange:	This action / decision is performed by the plant operator.
Blue:	This activity / decision is performed by the system.
Red:	This activity is performed by maintenance (service team).
Black:	Jumps to other process steps.

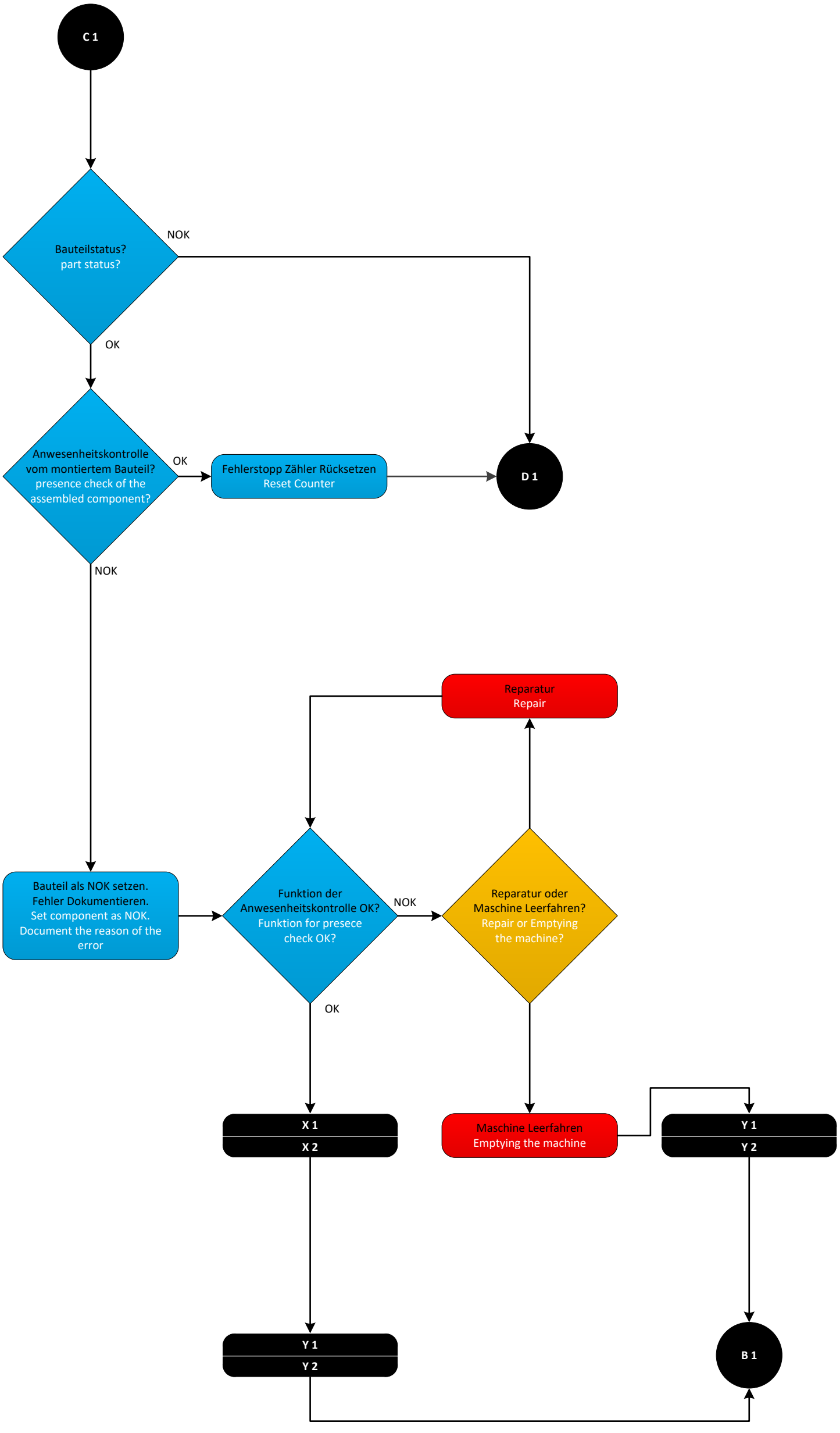
2.2. (A) Production start



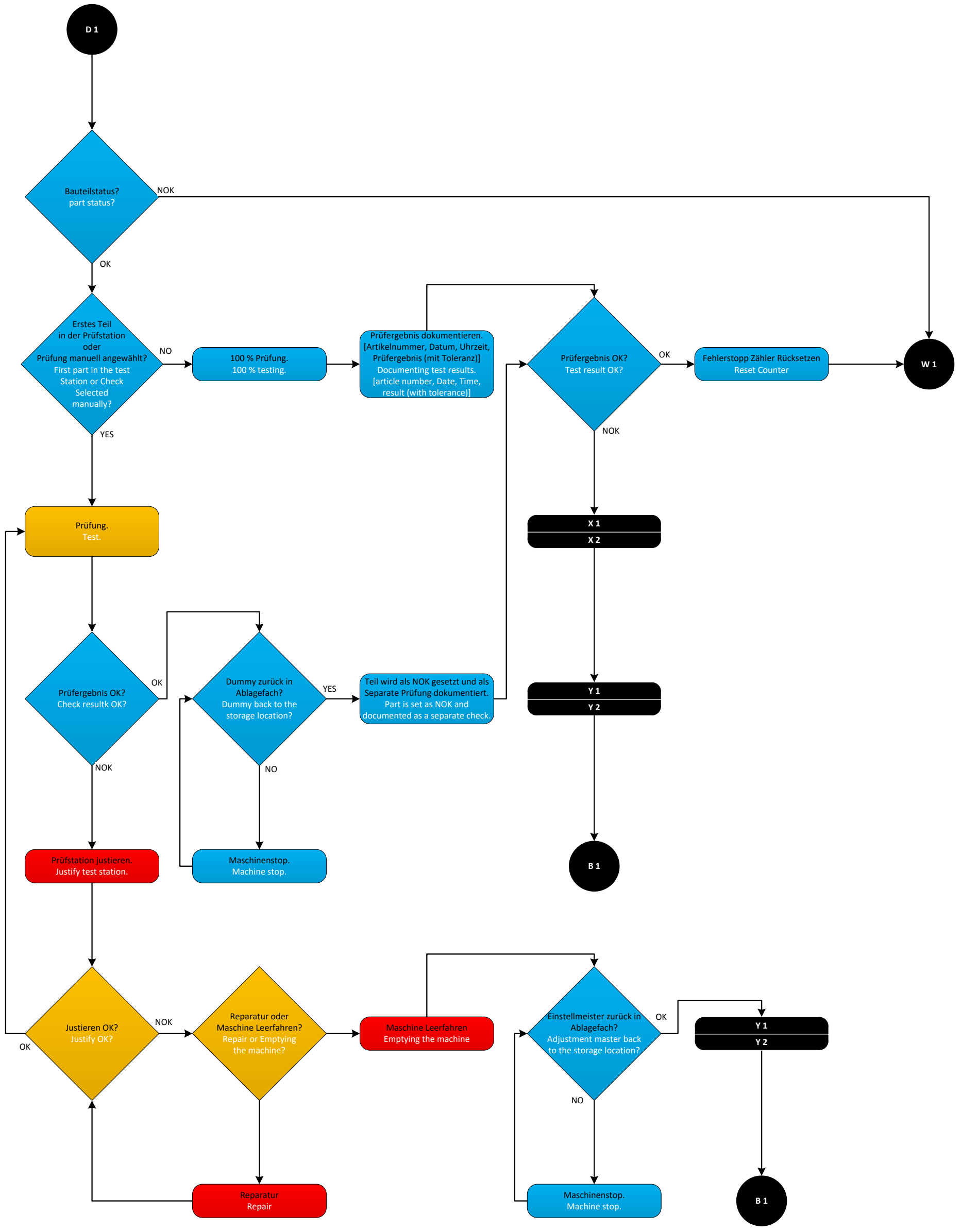
2.3. (B) Individual part check



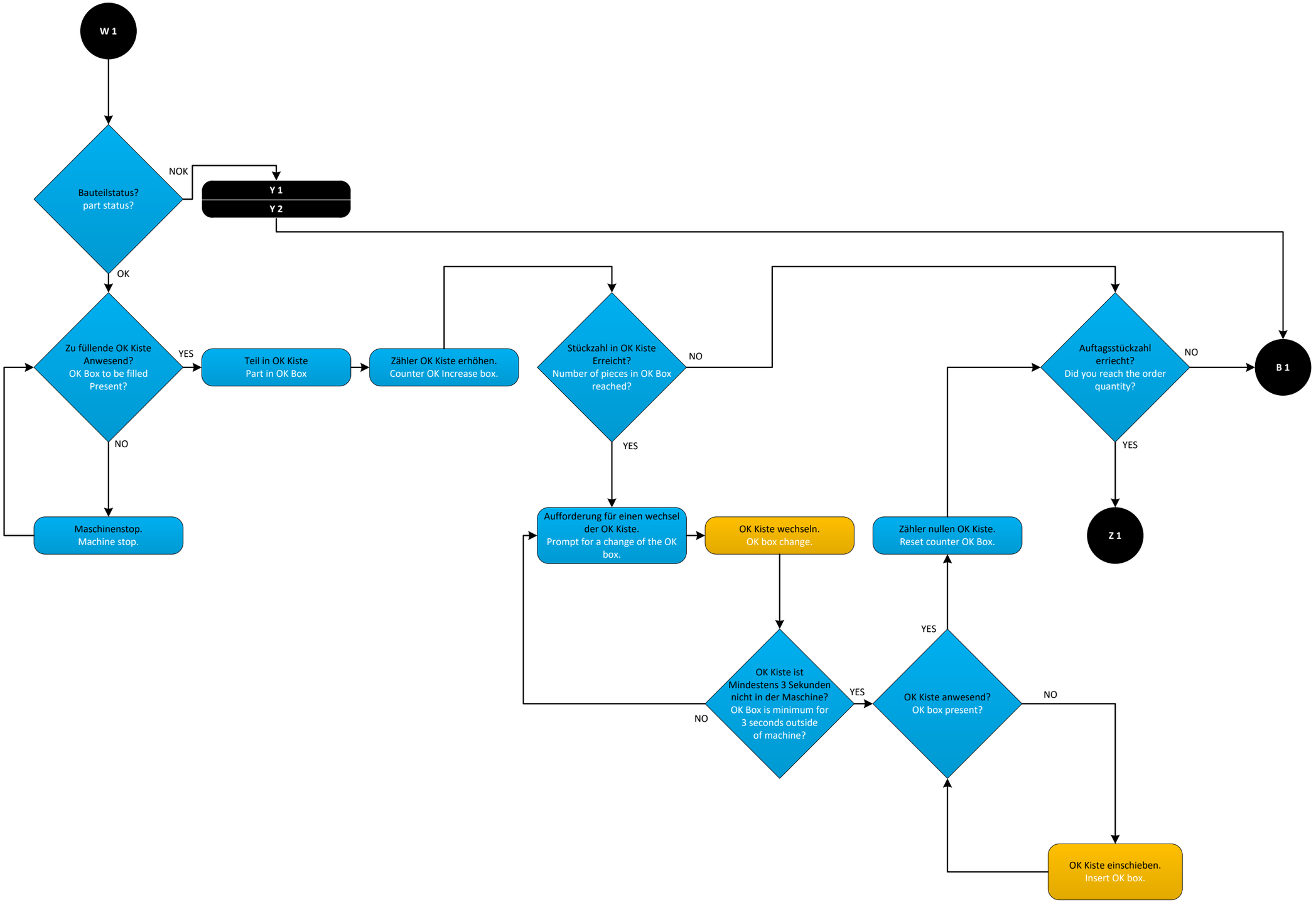
2.4. (C) Check of presence



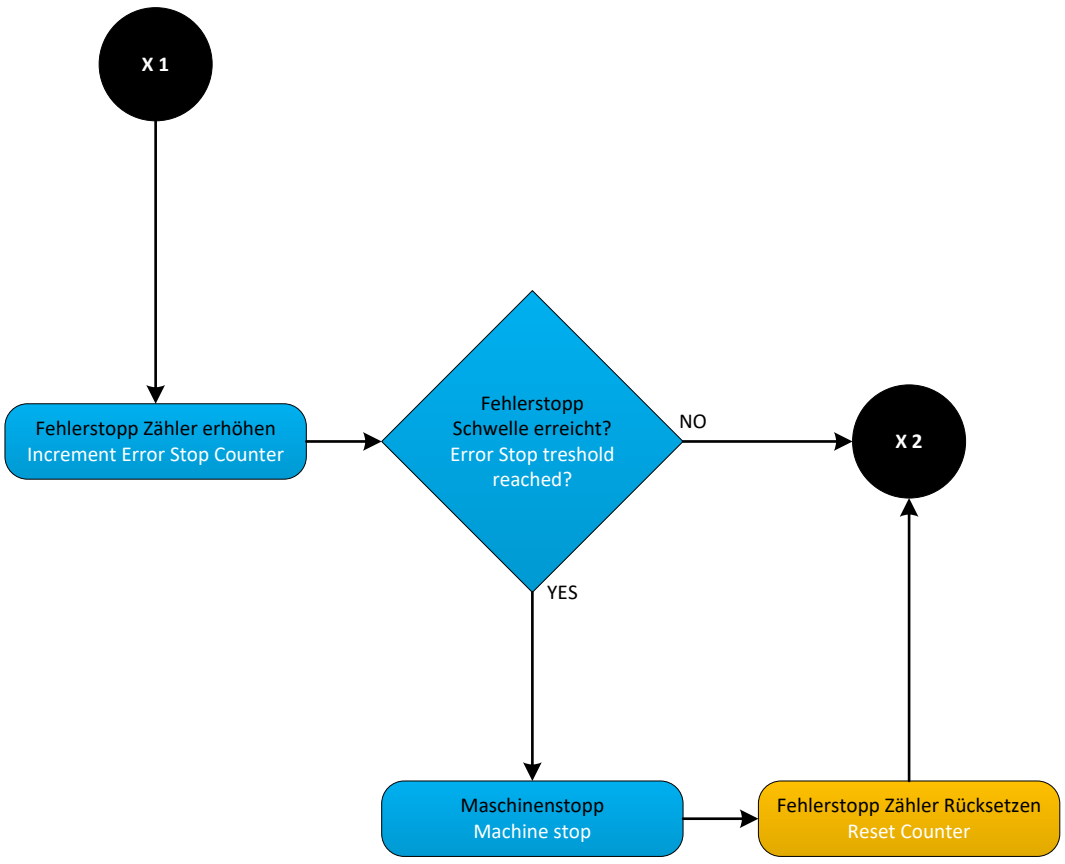
2.5. (D) Assembly check



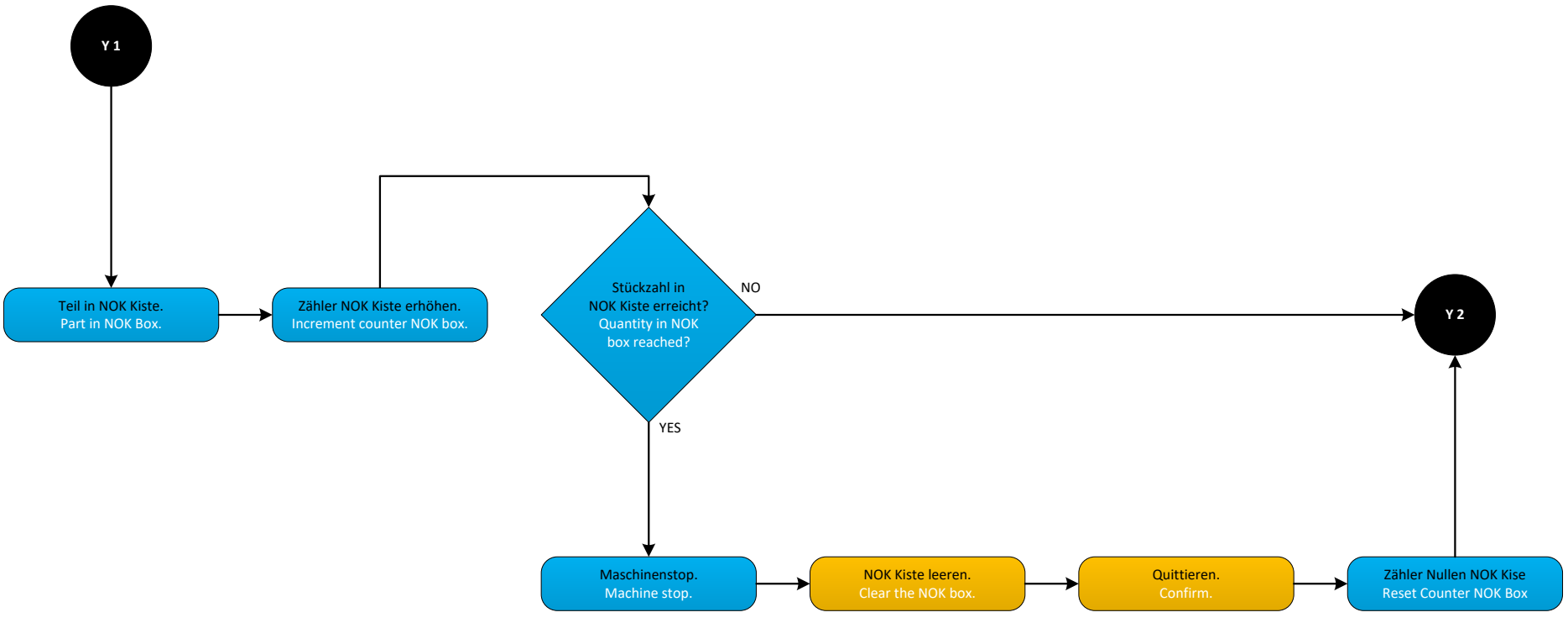
2.6. (W) OK components



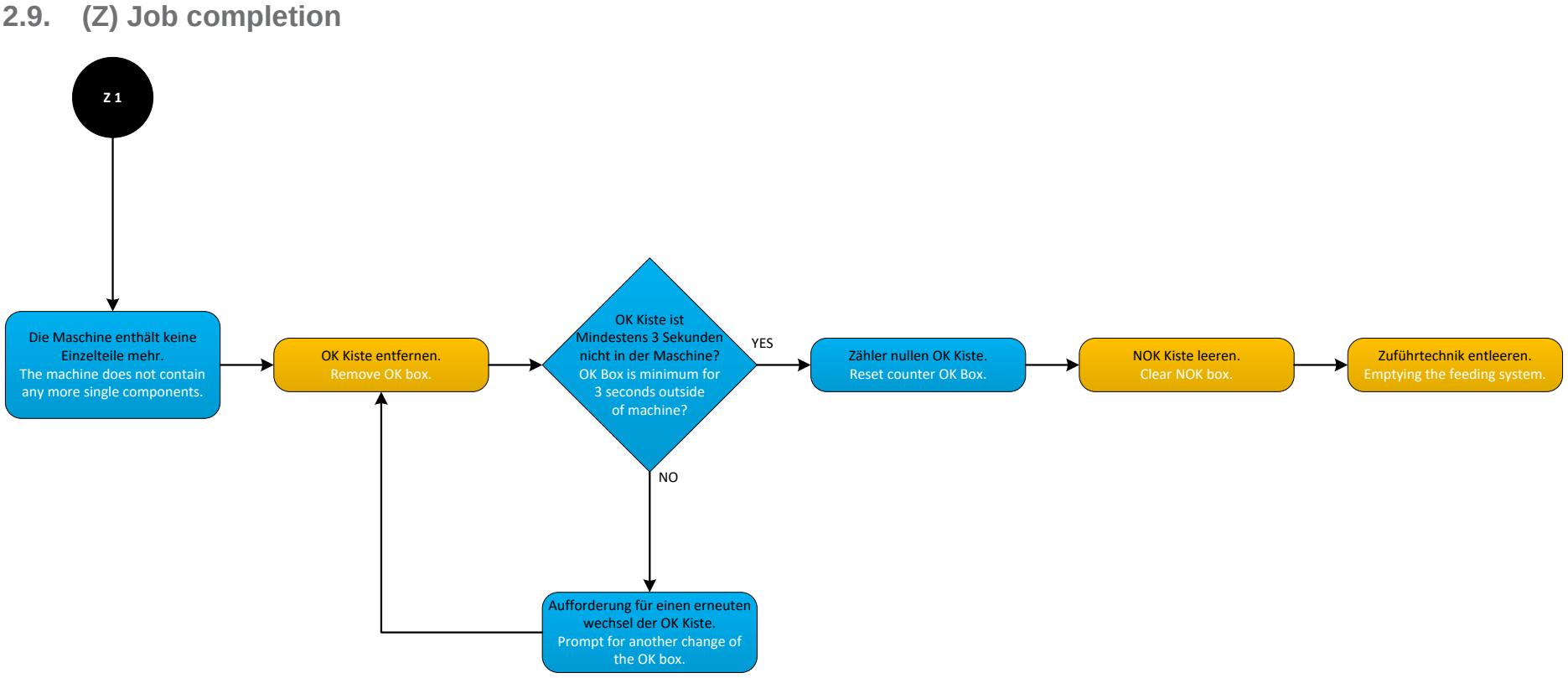
2.7. (X) Error stop



2.8. (Y) NOK (reject) components

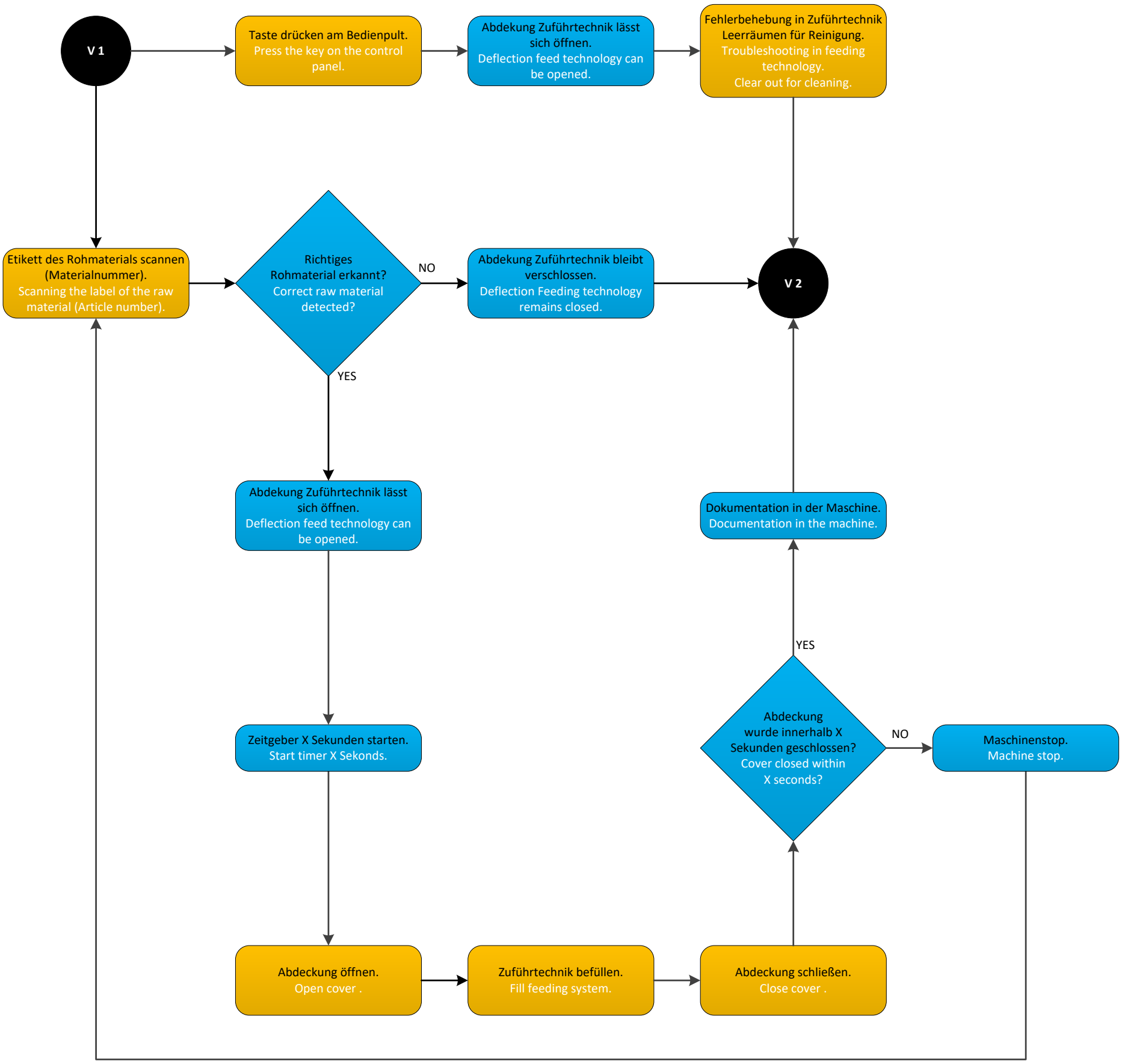


2.9. (Z) Job completion



2.10. (V) Raw material scan

If required, the individual parts must be digitally recorded and compared before they enter the feeding system.
The label of the container used must be scanned using the scanner.
Data acquisition occurs in system control. The scanned material number is also documented for the order (Traceability).
The covers of the feed technology (bunker / spiral conveyor) remain locked until they are released via the system.



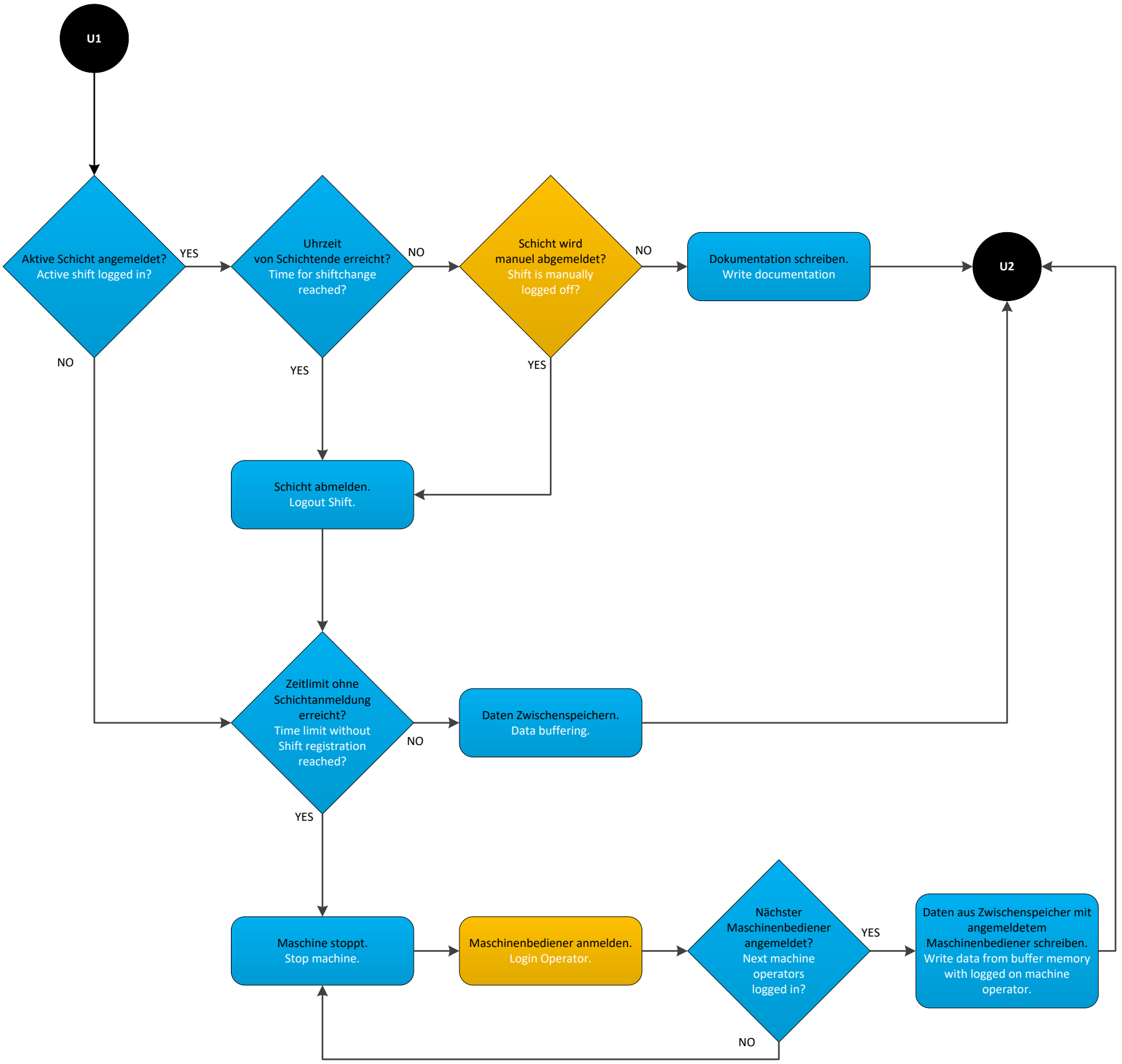
Date	Time	Order number	Material umber	Part no.	Batch no. St A	Batch no. St B	Batch no. St C
31.08.2018	07:35:04	1638993683	805-120-501	1	100A1111	100B2222	100C3333
31.08.2018	07:35:05	1638993683	805-120-501	2	100A1111	100B2222	100C3333
31.08.2018	07:35:06	1638993683	805-120-501	3	100A1111	100B2222	100C3333
31.08.2018	07:35:07	1638993683	805-120-501	4	100A1111	100B2222	100C3333
31.08.2018	10:00:00	1638993777	805-120-502	1	200A1111	100B2222	200C3333
31.08.2018	10:00:01	1638993777	805-120-502	2	200A1111	100B2222	200C3333
31.08.2018	10:00:02	1638993777	805-120-502	3	200A1111	100B2222	200C3333
31.08.2018	17:00:00	1638993777	805-120-502	4	200A1111	100B2222	200C3333
31.08.2018	17:00:01	1638993777	805-120-502	5	200A1111	100B2222	200C3333

2nd11th (U) Automatic and manual shift logout

The automatic shift logout contains the following time structure, which must remain editable for Hirschmann Automotive.

	Early shift	Late shift	Night shift
Monday	05:00 – 13:00	13:00 – 21.00	21:00 – 05:00
Tuesday	05:00 – 13:00	13:00 – 21.00	21:00 – 05:00
Wednesday	05:00 – 13:00	13:00 – 21.00	21:00 – 05:00
Thursday	05:00 – 13:00	13:00 – 21.00	21:00 – 05:00
Friday	05:00 – 13:00	13:00 – 21.00	21:00 – 05:00
Saturday	05:00 – 13:00	13:00 – 21.00	21:00 – 05:00
Sunday	05:00 – 17:00	17:00 – 05:00	

At the end of the shift, the logged in system operator is logged out, at which point the system continues to run.
If no new system operator is logged in after 2 hours, the system stops.
After the login of the next plant operator, the data of the preceding 2 hours will be assigned to the newly logged-in plant operator.
The following flowchart should be used for the procedure.



3. Automated documentation

3.1. General

The documentation for quantitative and qualitative results, orders and shifts is necessary for Hirschmann Automotive's internal evaluations as well as for quick troubleshooting and analysis.
This documentation must be permanently stored on the system.

3.1.a File path

The collective file path for storage is as follows: D:\Daten\
The individual documentation is saved in subfolders listed in 3.2, 3.3 and 3.4..

3.1.b File name

The file name for each individual documentation is created from the date the machine is produced.
The date must be in the format „YYYYMMDD“.

3.1.c File format

All documentation must be saved in CSV format.

3.1.d Table format

Columns are separated using a semicolon „**;**“.
No additional characters are allowed in strings, e.g. for the string 805-120-501:

- „805-120-501“.
- ‘805-120-501‘.
- %805-120-501%.

3.1.e EOL conversion

The EOL (End of Line) must be in Windows format (CR LF).

3.2. Documentation of measurement values

All inspections that are initiated in the system must be documented.
These inspections can be the following:

- Tactile inspections
- Optical inspections
- Inspections by means of sensors

These inspection results must be documented for each machine cycle.

3.2.a Folder structure

The file path for inspection results is: D:\Daten\Station + Nummer\
If multiple test results are determined on a station, the station number may be subdivided into its name as, for example:

- Station 1_1.
- Station 1_2.
- Station 1_Colour.
- Station 1_Coding, etc..

3.2.b Information on the documentation

The contents of the table include the following:

a) Date.
b) Time.
c) Order number.
d) Material number.
e) Continuous part number (serial number of the component) in the order.
f) Actual dimensions.
g) Tolerance lower limit.
h) Tolerance upper limit.

The table format must be as shown in the following tables:

Return of a measurement value

If real measurements can be recorded during a test, e.g. mm, pixels, g, etc. use this scheme of documentation.
The actual values must be documented as accurately as possible.

Date	Time	Order number	Material number	Part no.	Actual	LL	UL
31.08.2018	07:35:04	1638993683	805-120-501	1	2,51	2,40	2,60
31.08.2018	07:35:05	1638993683	805-120-501	2	2,49	2,40	2,60
31.08.2018	07:35:06	1638993683	805-120-501	3	**1,50**	2,40	2,60
31.08.2018	07:35:07	1638993683	805-120-501	4	2,48	2,40	2,60
31.08.2018	10:00:00	1638993777	805-120-502	1	2,48	2,40	2,60
31.08.2018	10:00:01	1638993777	805-120-502	2	2,49	2,40	2,60
31.08.2018	10:00:02	1638993777	805-120-502	3	2,51	2,40	2,60
31.08.2018	17:00:00	1638993777	805-120-502	4	2,52	2,40	2,60
31.08.2018	17:00:01	1638993777	805-120-502	5	2,50	2,40	2,60

Return of a valuation

If no real measured values can be recorded during a test, or if the system outputs only OK or NOK in the test, this documentation scheme should be used.
Here, OK parts are documented with 1, NOK parts with 0.

Date	Time	Order number	Material number	Part no.	Actual	LL	UL
31.08.2018	07:35:04	1638993683	805-120-501	1	1	1	1
31.08.2018	07:35:05	1638993683	805-120-501	2	1	1	1
31.08.2018	07:35:06	1638993683	805-120-501	3	**0**	1	1
31.08.2018	07:35:07	1638993683	805-120-501	4	1	1	1
31.08.2018	10:00:00	1638993777	805-120-502	1	1	1	1
31.08.2018	10:00:01	1638993777	805-120-502	2	1	1	1
31.08.2018	10:00:02	1638993777	805-120-502	3	1	1	1
31.08.2018	17:00:00	1638993777	805-120-502	4	1	1	1
31.08.2018	17:00:01	1638993777	805-120-502	5	1	1	1

Part number

The consecutive numbering of part numbers is started again from the beginning for each job, provided that it is newly created in the system.
If the system is merely emptied (for example, for cleaning and maintenance) or the order is extended, the part numbering will continue.

Logic

If a component is assessed as NOK at the previous station, the documentation for this component will not be continued at the following stations. See example with part no 3 as an NOK part.

Date	Time	Order number	Material number	Part no.	Station 1		
					Actual	LL	UL
31.08.2018	07:35:04	1638993683	805-120-501	1	2,51	2,40	2,60
31.08.2018	07:35:05	1638993683	805-120-501	2	2,49	2,40	2,60
31.08.2018	07:35:06	1638993683	805-120-501	**3**	**1,50**	2,40	2,60
31.08.2018	07:35:07	1638993683	805-120-501	4	2,48	2,40	2,60

Date	Time	Order number	Material number	Part no.	Station 2		
					Actual	LL	UL
31.08.2018	07:35:05	1638993683	805-120-501	1	1	1	1
31.08.2018	07:35:06	1638993683	805-120-501	**2**	1	1	1
31.08.2018	07:35:08	1638993683	805-120-501	**4**	1	1	1

Check

To verify whether the structure of the individual tables is coherent with each other, the measured value tables and evaluation tables of the respective test stations can be placed next to each other in relation to the part number. This structure must form which is represented in the table.

Station 2				Station 4 Camera1				Station 4 Camera 2				Station 6				Station 8 Camera			
Part no.	Actual	LL	UL	Part no.	Actual	LL	UL	Part no.	Actual	LL	UL	Part no.	Actual	LL	UL	Part no.	Actual	LL	UL
1	10,00	9,50	10,50	**1**	1	1	1	**1**	1	1	1	**1**	5,00	4,70	5,30	**1**	1	1	1
2	**8,00**	9,50	10,50																
3	9,70	9,50	10,50	**3**	**0**	1	1	**3**	**0**	1	1								
4	9,60	9,50	10,50	**4**	**0**	1	1	**4**	1	1	1								
5	9,80	9,50	10,50	**5**	1	1	1	**5**	**0**	1	1								
6	9,90	9,50	10,50	**6**	1	1	1	**6**	1	1	1	**6**	**3,00**	4,70	5,30				
7	10,10	9,50	10,50	**7**	1	1	1	**7**	1	1	1	**7**	5,10	4,70	5,30	**7**	**0**	1	1

3.3. Shift Documentation

3.3.a Folder structure

The file path for shifts is: D:\Daten\Schicht\

3.3.b Information on the documentation

The respective shift is written in the file name on the day in which it began.
Only one shift is documented when the machine is producing. There is no documentation during machine downtime (production-free days).
The contents of the table include the following:

a) Date (shift began).
b) Shift began.
c) Shift ended.
d) Shift (early, late, night).
e) Order number.
f) Material number.
g) Time (recorded as beginning of shift).
h) Plant operator (staff number of up to 8 digits).
i) Total count of OK parts after shift end.
j) Total count of NOK parts after shift end.
k) Each station has a detailed shift-related station counter of OK parts after the end of a shift.
l) Each station has a detailed shift-related station counter of NOK parts after the end of a shift.

Indexes k and l can be repeated several times per station.

Structure of the shift documentation
The table format must be as shown in the following tables:

a	b	c	d	e	f	g	h	i	j	k	l	k	l
										ST 1 Colour		**ST 1 Coding**	
01.01.2018	05:00:00	13:00:00	Früh	1444444444	805-120-501	05:01:32	0815	25.000	4	25.001	3	25.003	1
01.01.2018	13:00:00	21:00:00	Spät	1444444444	805-120-501	13:02:01	7153	24.000	1	24.001	0	24.000	1
01.01.2018	13:00:00	21:00:00	Spät	1555555555	805-120-502	13:02:01	7153	1.000	0	1.000	0	1.000	0
01.01.2018	21:00:00	05:00:00	Nacht	1555555555	805-120-502	21:01:02	98531	25.000	3	25.000	3	25.003	0

3.4. Order Documentation

3.4.a Folder structure

The file path for shifts is: D:\Daten\Auftrag\

3.4.b Information on the documentation

The complete job is saved with the file name of the day on which it was started, even if the job takes several days.
If several orders are produced in one day, they are all saved in the same file.
The contents of the table include the following:

a) Date of order start.
b) Time of order start.
c) Date of job completion.
d) Time of job completion.
e) Order number.
f) Material number.
g) Total count of OK parts after job completion.
h) Total count of NOK parts after job completion.
i) Each station has a detailed order-related station counter of OK parts after job completion.
j) Each station has a detailed order-related station counter of NOK parts after job completion.

Indexes i and j can be repeated several times per station.

Structure of the shift documentation
The table format must be as shown in the following table:

a	b	c	d	e	f	g	h	i	j	i	j
								ST 1 Colour		ST 1 Coding	
01.01.2018	06:05:02	01.01.2018	17:25:32	1444444444	805-120-501	10.000	8	10.003	3	10.005	5
01.01.2018	17:26:08	02.01.2018	02:48:25	1555555555	805-120-502	35.000	1	35.000	1	35.001	0

3.5. Control

The totals of the number of pieces produced per shift must be identical to the number of pieces in the order documentation. This includes the total counters and the station counters.

- Shift documentation.

Date	Shift began	Shift ended	Shift	Order number	Material number	Time	Operator	Total Count OK	Total Count NOK	Station 1		Station 2	
										OK	NOK	OK	NOK
01.01.2020	05:00:00	13:00:00	Früh	1234567890	805-120-501	05:01:32	0815	25.000	4	25.003	1	25.000	3
01.01.2020	13:00:00	21:00:00	Spät	1234567890	805-120-501	13:02:01	7153	24.000	1	24.001	0	24.000	1
01.01.2020	21:00:00	05:00:00	Nacht	1234567890	805-120-501	21:20:12	1234	23.000	12	23.012	10	23.000	2
02.01.2020	05:00:00	13:00:00	Früh	1234567890	805-120-501	05:07:59	0815	25.000	0	25.000	0	25.000	0

- Order documentation.

Date of order start	Time of order start	Date of order end	Time of order end	Order number	Material number	Total Count OK	Total Count NOK	Station 1		Station 2	
								OK	NOK	OK	NOK
01.01.2020	06:05:02	02.01.2020	12:25:32	1234567890	805-120-501	97.000	17	97.016	11	97.000	6

4. Software

4.1. Control panel display

4.1.a Control system

For Hirschmann Automotive, it is important that the software menu is „Red Thread“-driven.
The path of the menu you are currently in must always be displayed.
Keys / fields that can not be selected or edited due to the user level must be "greyed out".

4.1.b Keys

For touchscreen displays, the buttons are to be displayed in a minimum size of at least 20mm x 12mm (length x height).

4.1.c Font

The font and font size for the display should be defined as follows:
The font is „Arial“.
Smallest permissible font size „10“.

4.1.d Main menu

Das Hauptmenü muss übersichtlich und praktisch gestaltet werden.
Desweiterem müssen folgende Informationen visualisiert werden:

- Material number.
- Current total order quantity.
- Currently produced order quantity.
- Currently produced OK order parts.
- Currently produced NOK order parts.
- Remaining time of the current order quantity.
- Current capacity of the OK box.
- Target capacity of the OK box.
- Level indicator of the OK box in %.
- System operator personnel number.
- Date.
- Time.
- Initial information, error, fault messages in the order in which they must be rectified.
- Cycle output.
- Order-related system performance.

4.1.e Station menu

The following information must be available in the station menu:

- Menu path displayed depiction.
- Category in which you want to progress further.
  e.g.: gripper, cylinder, feed technology, quality features, station settings (dwell times, travels of the axes, gripper positions (open / closed), etc.).

4.1.f Counter menu NOK parts

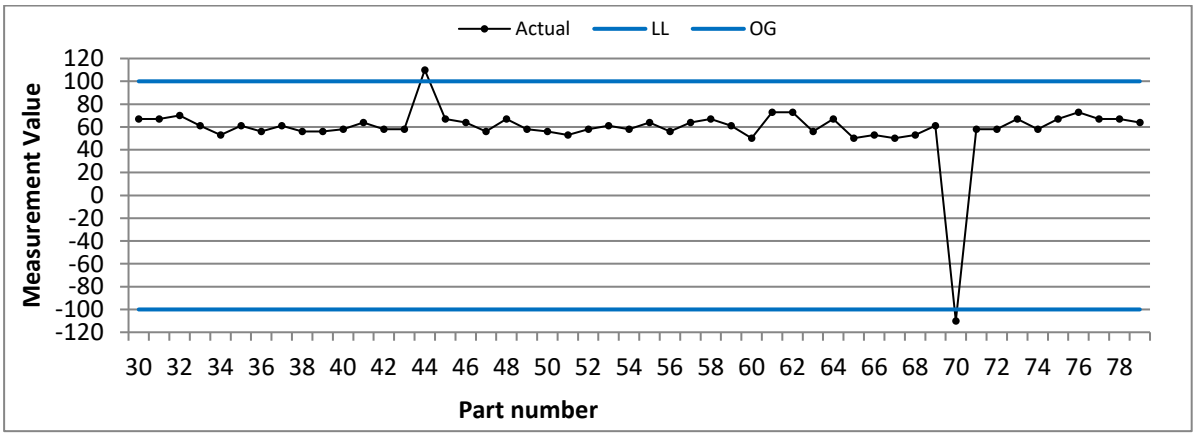
In the counter menu, all stations at which counters are stored are listed according to the order and shift documentation (stations). Here 3 of each counters must be deposited for OK and NOK parts:

- Shift counter.
- Order counter.
- Total counter.

The shift counter can be reset by the system operator.
The order counter is automatically reset when the next job starts.
The total counter can only be reset or edited by the maintenance team (user level).

4.1.g Measurement values

The menus of the measuring stations must each have a display of at least the minimum last 50 measured values for each measurement. Ideally, a line diagram should be used for the display. The scaling of the measured value series in the diagram must be automatically adjusted to the minimum and maximum measured value.



4.2. Formulation extension

Hirschmann Automotive must be able to expand the system formula of the components, providing this has no influence on tests or other system elements.
As a rule, existing components known to the system supplier are combined with one another in an extension or labelled differently.
New components with different geometries that were not known at the time the system was delivered are usually created by the system supplier.

4.3. Camera systems / Vision sensors

If camera systems are used within the system, the following must be observed for product monitoring systems:

4.3.a Settings for image storage

It must be possible to which images should be stored by each camera select in the control system (operator panel):

- Only OK parts.
- Only NOK parts.
- OK and NOK parts.

4.3.b Storage space / Storage duration

The storage duration for images must be as follows:

- For OK images, space for storage must be provided for 1 week.
- For NOK images, space for storage must be provided for 3 months.

Deleting images
The stored images are not automatically deleted after the defined storage time has elapsed. Only the oldest image may be deleted once the storage capacity has been surpassed.

4.3.c Storage path and structure

Each camera must have its own path / folder for the storage of images.
This memory structure can be structured as follows:

- Camera_1/OK Parts/Item number/.
- Camera_1/NOK Parts/Item number/.
- Camera_2/OK Parts/Item number/.
- Camera_2/NOK Parts/Item number/.

4.3.d Naming

Image naming must be based on the order number and part no. so that the images can be assigned to the measured value documentation 3.2 can be assigned.

An example would be:

- 1638993683_0000001.JPG.
- 1638993683_0000002.JPG.
- 1638993683_0000003.JPG.
- 1638993683_0000004.JPG.
- 1638993683_0000005.JPG.
- 1638993777_0000001.JPG.
- 1638993777_0000002.JPG.
- 1638993777_0000003.JPG.

The measurement specification must be included in the image so that it can be understood later why the part was treated as a NOK part or as an OK part.

5. Test systems and environment

Test systems must be subject to a special verification according to IATF 16949, which recognizes their correct function.
This verification can be performed by the following means:

- Self-verification.
- Error Proof Part.
- Defect Sample.

In the case of camera systems, two main sources of error must be distinguished:

- Software.
- Hardware.

In the case of software, a distinction is again made between the firmware and the actual test program. If either of these is changed, the functionality must be proven again by means of a measurement system analysis (attributive or quantitative MSA).
As long as no changes have been made to the focus or illumination, this can be done with saved NOK and OK images.

In the case of hardware, an adjustment of system components or a complete failure of the system must be assumed. In the case of the primary failure, the lens and the illumination are the critical factors.

5.1. Verification methods

The following methods can be used to guarantee permanent and proper functioning:

5.1.a Self-check

100% verification for each part. For this purpose, in addition to the actual inspection characteristics, an additional inspection of a characteristic that is permanently connected to the system is also carried out. Here are a few examples:

- a hole, whose diameter is checked.
- surface whose brightness and / or color is checked.

5th1stb Setting master („Error-Proof-Part“)

This is a part (subject to cyclic calibration) that represents the characteristic to be checked.
The following should be noted for this verification method:

- Setting masters are preferably to be made of metal.
- The setting masters are to be designed in OK and NOK versions.
    - The OK design should be nearly centered in the nominal dimension.
    - The NOK versions must be well outside the upper and lower tolerances.
- It must be possible to insert the setting master into the test station easily and with good access.
- The machine must be empty during the inspection so that no series products next to the station to be inspected can be damaged by the operator.
- The setting master must be placed in a holder in the immediate vicinity of the testing station.
- The setting master must be monitored for its presence by means of a sensor so that it is secured against loss. I.e. the machine must stop serial production until the setting master is back at its designated place.

5th1stcManipulated serial product („defect sample“)

This is a manipulated serial product, which has a defined defect, which the machine must detect.
The following must be observed for this inspection method:

- It must be possible to insert the manipulated serial product into the test station easily and in a readily accessible manner.
- The machine must be empty during the inspection, so that no serial products can be damaged by the operator next to the station to be inspected.

In consultation with Hirschmann Automotive, additional may need to be adhered to:

- The Manipulated Serial Product must be placed in a holder in the immediate vicinity of the testing station.
- The Manipulated Serial Product must be monitored for its presence by means of a sensor so that it is secured against loss. I.e. the machine must stop the serial production until the Manipulated Serial Product is back at its designated place.

5th1std Procedure for „Error-Proof-Part“ and „Defective Sample“

The test is performed in the following steps:

1) The operator presses a button on the HMI that activates the check.
2) The machine starts the empty run.
3) The operator receives step-by-step instructions from the HMI on when to insert the “Error-Proof Part” or “Defective Sample” into the testing station.
4) Evaluation of the test station.
5) The operator receives a step-by-step instruction from the HMI when the “Error-Proof-Part” or “Defective Sample” must be removed from the test station.
6) The machine starts again with serial production.