Question 3 Broken Sensors Insights

Grünglass Analysis

1. **List of Device ID that had NaN values at one point**

device_id	
96e70afa-3ce0-4674-a331-8b85aed97068	9412
2e4a8f6d-d398-4749-bc74-a24efa3f5644	9356
cfcfb74d-b13e-43fb-bc59-9eee4f6be818	9208
36816c9e-3b69-4b8c-b9f7-150b0edf94db	8781
11d4bcfe-bde2-42bd-8ebc-43ee77012480	8538
b5b36857-0f47-4df9-8c8a-0ff431875b18	8430
62ec2345-9665-4fd2-9fa7-91ead95dc99b	8327
e194deb4-afb0-4c83-aab2-71fcd13ca4e8	7799
f97fcfd4-a7a8-4839-958a-334d8c02566c	5126
a82a9f13-4ec0-45bd-a218-4e2cc4ca11bb	4645
aae16e11-7f7e-4251-9e73-fd836db67b79	1367
a3e91e80-9b8d-4bd6-bbd7-011319e05a0c	1366
b4d0f672-6436-483e-a0cd-fab4fe552a8c	1352
7f9cad51-8a0c-4fa9-a6d4-8cf649d819ab	1339
134fc269-ec25-466f-82e7-780beb314108	1280
496ebab5-e27f-46a4-91bd-28e5086eb594	1248
5fe079a9-6e53-4a9d-b974-eca5d0916632	916
eaea0bcc-2970-41e1-8821-29be122a65b0	739
3301af3b-a6fe-429e-8b01-c7b71249abdf	695
8a6b6d27-9149-40ea-88b6-0c0d7446a0df	607
e785cb18-96e1-4215-931a-82a731d2ee5a	560
0b011106-e5fe-4202-92bd-c89abd042249	475
1607ca61-c966-483d-bbfb-d97027d507c1	289
79d9a5cb-3704-4a21-aedf-5989c70baed0	183
e3a7cfea-c281-46fe-8758-0bf2388181c0	17

2. **From which time frame were they broken? (UTC time)**

Oldest timestamp 2020-01-01 00:01:03+00:00 with Device ID: 2e4a8f6d-d398-4749-bc74-a24efa3f5644

Newest timestamp 2023-11-30 21:02:51+00:00 with Device ID: 1a207c30-2820-4a68-a50a-602d5261c723

Detailed Analysis Grünglas:

We programmed a function that defines a start and end date for NaN values for each Device ID. At first, we said a time frame is a NaN time segment if all the dates are continuous in between the start and end date meaning a NaN time segment could be 20.01.2020, 21.01.2020, 22.01.2020 and so on. However, we noticed that this would create 78 NaN time segments for one Device ID 96e70afa-3ce0-4674-a331-8b85aed97068) and thus decided to be more tolerant so that if there was a NaN value on the 20.01.2020 and on the 22.01.2020 it would still be under the same NaN time segment. With this, we cut the 78 NaN time

segments down to 8 time segments. Depending on the needs of the customer, the time tolerance for the NaN time segments can be adjusted.

Which Device ID is it and from when until when was it broken?

DataFrame df_1 - Device ID: 8a6b6d27-9149-40ea-88b6-0c0d7446a0df:

	Start Date	End Date
0	2020-06-17	2020-10-08
1	2020-10-11	2020-11-01
2	2020-11-05	2020-11-13
3	2020-11-16	2021-07-08
4	2021-07-11	2022-01-18
5	2022-01-22	2022-01-22
6	2022-01-27	2022-02-02
7	2022-02-08	2022-02-08
8	2022-02-16	2022-02-16
9	2022-04-09	2022-04-09
10	2022-04-17	2022-04-18
11	2022-12-16	2022-12-18
12	2023-01-21	2023-01-25
13	2023-06-08	2023-06-13
14	2023-07-14	2023-07-16

- Last working day 2023-7-22
- Percentage of NaN values: 2.26%

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DataFrame df_2 - Device ID: eaea0bcc-2970-41e1-8821-29be122a65b0:

	Start Date	End Date
0	2020-06-17	2020-07-02
1	2020-07-05	2020-09-09
2	2020-09-12	2020-09-24
3	2020-09-27	2020-10-02
4	2020-10-05	2020-10-07
5	2020-10-10	2020-10-11
6	2020-10-14	2020-10-22
7	2020-10-26	2020-10-26
8	2020-10-29	2020-11-01
9	2020-11-04	2021-05-23
10	2021-05-26	2021-11-18
11	2021-11-21	2022-01-23
12	2022-01-26	2022-01-27
13	2022-01-30	2022-07-26
14	2022-07-29	2022-07-30
15	2022-08-02	2022-08-02

- Last working day 2022-08-02
- Percentage of NaN values: 2.21%

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DataFrame df_3 - Device ID: cfcfb74d-b13e-43fb-bc59-9eee4f6be818:

	Start Date	End Date
0	2020-01-01	2020-07-22
1	2020-07-25	2020-10-04
2	2020-10-07	2020-10-14
3	2020-10-18	2020-10-18
4	2020-10-22	2020-10-22
5	2020-10-26	2020-11-08
6	2020-11-11	2020-11-11
7	2020-11-14	2020-11-18
8	2020-11-22	2020-11-23
9	2020-11-26	2021-03-29
10	2021-04-09	2021-06-08
11	2021-06-11	2021-06-16
12	2021-06-19	2021-07-14
13	2021-07-18	2021-08-12
14	2021-08-17	2021-11-30
15	2021-12-03	2022-02-15
16	2022-02-18	2022-03-11

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17  2022-03-14  2022-03-24
18  2022-03-27  2022-06-28
19  2022-07-02  2022-10-06
20  2022-10-09  2022-10-11
21  2022-10-15  2022-12-28
22  2022-12-31  2023-01-23
23  2023-01-26  2023-02-05
24  2023-02-08  2023-03-02
25  2023-03-05  2023-03-11
26  2023-03-14  2023-04-24
27  2023-04-27  2023-05-03
28  2023-05-06  2023-05-13
29  2023-05-16  2023-09-02
30  2023-09-05  2023-10-13
31  2023-10-16  2023-10-23
```

- Last working day 2023-10-23
- Percentage of NaN values: 15.51%

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DataFrame df_4 - Device ID: 62ec2345-9665-4fd2-9fa7-91ead95dc99b:
    Start Date    End Date
0   2020-01-01  2020-08-04
1   2020-08-07  2020-10-30
2   2020-11-02  2020-11-05
3   2020-11-08  2020-11-23
4   2020-11-27  2021-03-28
..         ...         ...
69  2023-09-06  2023-09-10
70  2023-09-14  2023-09-15
71  2023-09-18  2023-09-20
72  2023-09-23  2023-09-29
73  2023-10-02  2023-10-10

[74 rows x 2 columns]
```

- Last working day 2023-10-10
- Percentage of NaN values: 17.17%

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DataFrame df_5 - Device ID: 3301af3b-a6fe-429e-8b01-c7b71249abdf:
   Start Date    End Date
0  2020-06-17  2020-10-14
1  2020-10-17  2020-10-22
2  2020-10-25  2020-11-02
3  2020-11-05  2020-11-07
4  2020-11-10  2020-11-16
5  2020-11-23  2021-03-04
6  2021-03-07  2021-04-18
7  2021-04-21  2022-02-08
8  2022-02-11  2022-05-21
```

- Last working day 2022-05-21
- Percentage of NaN values: 2.21%

```
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DataFrame df_6 - Device ID: 11d4bcfe-bde2-42bd-8ebc-43ee77012480:
   Start Date    End Date
0  2020-01-01  2020-05-07
1  2020-05-11  2020-10-05
2  2020-10-11  2020-10-17
3  2020-10-20  2020-11-03
4  2020-11-06  2020-11-21
5  2020-11-24  2020-11-24
6  2020-11-27  2021-11-08
7  2021-11-11  2022-04-06
```

- Last working day 2022-04-07
- Percentage of NaN values: 22.45%

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DataFrame df_7 - Device ID: e785cb18-96e1-4215-931a-82a731d2ee5a:

	Start Date	End Date
0	2020-06-17	2020-09-29
1	2020-10-02	2020-10-18
2	2020-10-21	2020-10-26
3	2020-10-30	2020-11-07
4	2020-11-11	2020-11-18
5	2020-11-23	2020-12-21
6	2020-12-24	2021-11-22
7	2021-11-25	2021-12-24

- Last working day 2021-12-24
- Percentage of NaN values: 2.26%

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DataFrame df_8 - Device ID: 36816c9e-3b69-4b8c-b9f7-150b0edf94db:

	Start Date	End Date
0	2020-01-01	2020-10-16
1	2020-10-19	2020-10-24
2	2020-10-28	2020-11-02
3	2020-11-06	2020-11-08
4	2020-11-11	2021-10-14
5	2021-10-17	2022-04-06

- Last working day 2022-04-22
- Percentage of NaN values: 22.75%

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DataFrame df_9 - Device ID: b4d0f672-6436-483e-a0cd-fab4fe552a8c:

	Start Date	End Date
0	2020-06-18	2020-09-28
1	2020-10-03	2020-10-08
2	2020-10-12	2021-11-20
3	2021-11-23	2022-03-05
4	2022-03-08	2022-09-07
5	2022-09-10	2022-12-20
6	2022-12-24	2023-01-11
7	2023-01-14	2023-02-27
8	2023-03-02	2023-08-25
9	2023-09-02	2023-10-16
10	2023-10-27	2023-11-15
11	2023-11-20	2023-11-22

- Last working day 2023-11-22
- Percentage of NaN values: 2.49%

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DataFrame df_10 - Device ID: 2e4a8f6d-d398-4749-bc74-a24efa3f5644:

	Start Date	End Date
0	2020-01-01	2020-09-23
1	2020-09-29	2020-10-16
2	2020-10-19	2020-10-23
3	2020-10-26	2020-10-31
4	2020-11-03	2020-11-08
5	2020-11-11	2021-03-29
6	2021-04-16	2021-05-03
7	2021-05-07	2022-07-27
8	2022-08-10	2022-08-23
9	2022-08-26	2023-04-28
10	2023-05-10	2023-06-15
11	2023-06-20	2023-06-21
12	2023-06-24	2023-06-26

- Last working day 2023-06-26
- Percentage of NaN values: 16.44%

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DataFrame df_11 - Device ID: 5fe079a9-6e53-4a9d-b974-eca5d0916632:

```
   Start Date    End Date
0  2020-06-17  2020-07-01
1  2020-07-05  2020-07-19
2  2020-07-22  2020-09-29
3  2020-10-03  2020-10-06
4  2020-10-10  2020-10-30
5  2020-11-02  2020-11-15
6  2020-11-19  2022-08-10
7  2022-08-13  2022-10-30
8  2022-11-02  2022-11-29
```

- Last working day 2022-11-29
- Percentage of NaN values: 2.23%

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```
DataFrame df_12 - Device ID: 0b011106-e5fe-4202-92bd-c89abd042249:
   Start Date    End Date
0  2020-06-17  2020-07-03
1  2020-07-06  2020-09-29
2  2020-10-03  2020-10-18
3  2020-10-21  2020-10-24
4  2020-10-29  2020-10-31
5  2020-11-03  2021-07-25
6  2021-07-28  2021-10-23
```

- Last working day 2021-10-23
- Percentage of NaN values: 2.18%

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```
DataFrame df_13 - Device ID: aae16e11-7f7e-4251-9e73-fd836db67b79:
   Start Date    End Date
0  2020-06-17  2020-10-02
1  2020-10-06  2020-10-31
2  2020-11-04  2020-11-23
3  2020-11-26  2023-11-30
```

- Percentage of NaN values: 2.24%

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```
DataFrame df_14 - Device ID: b5b36857-0f47-4df9-8c8a-0ff431875b18:
   Start Date    End Date
0  2020-01-01  2020-10-02
1  2020-10-05  2020-10-16
2  2020-10-19  2020-11-17
3  2020-11-20  2021-03-29
```

- Last working day 2021-04-02
- Percentage of NaN values: 40.06%

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```
DataFrame df_15 - Device ID: 7f9cad51-8a0c-4fa9-a6d4-8cf649d819ab:
   Start Date    End Date
0  2020-06-17  2020-10-18
1  2020-10-21  2020-11-04
2  2020-11-07  2022-06-01
3  2022-06-04  2023-11-30
```

- Percentage of NaN values: 2.23%

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```
DataFrame df_16 - Device ID: 496ebab5-e27f-46a4-91bd-28e5086eb594:
    Start Date    End Date
0   2020-06-17  2020-07-04
1   2020-07-07  2020-09-28
2   2020-10-04  2020-10-15
3   2020-10-18  2020-10-19
4   2020-10-23  2020-10-23
5   2020-10-27  2020-11-02
```

```
6   2020-11-05  2020-11-12
7   2020-11-17  2020-11-23
8   2020-11-26  2022-05-07
9   2022-05-10  2022-07-11
10  2022-07-15  2022-07-16
11  2022-07-21  2022-08-24
12  2022-08-27  2022-08-31
13  2022-09-03  2022-09-03
14  2022-09-06  2023-04-11
15  2023-04-14  2023-11-30
```

- Percentage of NaN values: 2.22%

```
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DataFrame df_17 - Device ID: 96e70afa-3ce0-4674-a331-8b85aed97068:
   Start Date    End Date
0  2020-01-01  2020-10-08
1  2020-10-11  2020-10-22
2  2020-10-26  2020-11-19
3  2020-11-22  2020-11-23
4  2020-11-27  2022-01-28
5  2022-01-31  2022-07-12
6  2022-07-15  2023-01-18
7  2023-01-21  2023-11-30
```

- Percentage of NaN values: 14.29%

```
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DataFrame df_18 - Device ID: 134fc269-ec25-466f-82e7-780beb314108:
   Start Date    End Date
0  2020-06-17  2020-10-02
1  2020-10-05  2020-10-23
2  2020-10-26  2020-11-07
3  2020-11-11  2021-03-24
4  2021-03-27  2021-05-07
5  2021-05-10  2022-04-10
6  2022-04-13  2022-09-01
7  2022-09-05  2023-10-16
8  2023-10-19  2023-10-19
```

- Last working day 2023-10-19
- Percentage of NaN values: 2.29%

```
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DataFrame df_19 - Device ID: 1607ca61-c966-483d-bbfb-d97027d507c1:
   Start Date    End Date
0  2020-06-17  2020-07-07
1  2020-07-10  2020-10-24
2  2020-10-27  2020-11-21
3  2020-11-24  2021-03-24
```

- Last working day 2021-03-24
- Percentage of NaN values: 2.28%

```
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DataFrame df_20 - Device ID: 79d9a5cb-3704-4a21-aedf-5989c70baed0:
    Start Date    End Date
0   2020-06-16  2020-06-19
1   2020-06-22  2020-08-20
2   2020-08-25  2020-08-28
3   2020-08-31  2020-09-06
4   2020-09-09  2020-10-03
5   2020-10-06  2020-10-14
6   2020-10-17  2020-10-30
7   2020-11-02  2020-11-03
8   2020-11-06  2020-11-06
9   2020-11-09  2020-11-15
10  2020-11-19  2020-11-23
11  2020-11-26  2021-01-20
```

- Last working day 2021-01-21
- Percentage of NaN values: 2.17%

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DataFrame df_21 - Device ID: a3e91e80-9b8d-4bd6-bbd7-011319e05a0c:

	Start Date	End Date
0	2020-06-17	2020-07-01
1	2020-07-04	2020-10-02
2	2020-10-05	2020-10-24
3	2020-10-28	2020-10-28
4	2020-10-31	2020-11-06
5	2020-11-11	2020-11-14
6	2020-11-17	2020-11-18
7	2020-11-21	2020-11-23
8	2020-11-26	2021-03-12
9	2021-03-16	2021-08-14
10	2021-08-17	2021-11-15
11	2021-11-18	2021-11-23
12	2021-11-27	2021-12-28
13	2021-12-31	2022-01-28
14	2022-01-31	2022-04-07
15	2022-04-10	2022-04-12
16	2022-04-15	2023-03-17
17	2023-03-20	2023-04-24
18	2023-04-27	2023-11-30

- Percentage of NaN values: 2.43%

==========

DataFrame df_22 - Device ID: e3a7cfea-c281-46fe-8758-0bf2388181c0:

	Start Date	End Date
0	2020-06-16	2020-07-02

- Last Working Day 2022-07-03
- Percentage of NaN values: 2.10%

==========

DataFrame df_23 - Device ID: e194deb4-afb0-4c83-aab2-71fcd13ca4e8:

	Start Date	End Date
0	2020-01-01	2020-06-28
1	2020-07-02	2020-07-08
2	2020-07-11	2020-08-03
3	2020-08-06	2020-08-08

- Last Working Day 2020-08-08
- Percentage of NaN values: 78.66%

==========

DataFrame df_24 - Device ID: a82a9f13-4ec0-45bd-a218-4e2cc4ca11bb:

	Start Date	End Date
0	2020-01-01	2020-04-08

- No working day, the Device ID only consists of NaN values
- Percentage of NaN values: 100.00%

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DataFrame df_25 - Device ID: f97fcfd4-a7a8-4839-958a-334d8c02566c:

	Start Date	End Date
0	2020-01-01	2020-04-28

- No working day, the Device ID only consist of NaN values
- Percentage of NaN values: 100.00%

==========

- **There is no Device ID that has no NaN values**
- **Of the Grünglas dataset, there are 10.3% NaN values**

Good Quality Device ID (if last day = 30.11.2023) in green

Device ID: aae16e11-7f7e-4251-9e73-fd836db67b79:
Device ID: 7f9cad51-8a0c-4fa9-a6d4-8cf649d819ab:
Device ID: 496ebab5-e27f-46a4-91bd-28e5086eb594:
Device ID: 96e70afa-3ce0-4674-a331-8b85aed97068:
Device ID: a3e91e80-9b8d-4bd6-bbd7-011319e05a0c:

- 20% of Device IDs are in good quality

Medium Quality Device ID (if last day in 2023) in yellow

Device ID: 8a6b6d27-9149-40ea-88b6-0c0d7446a0df:
Device ID: cfcfb74d-b13e-43fb-bc59-9eee4f6be818:
Device ID: 62ec2345-9665-4fd2-9fa7-91ead95dc99b:
Device ID: b4d0f672-6436-483e-a0cd-fab4fe552a8c:
Device ID: 2e4a8f6d-d398-4749-bc74-a24efa3f5644:
Device ID: 134fc269-ec25-466f-82e7-780beb314108:

- 24% of Device IDs are in medium quality

Poor Quality Device ID (if last day before 2023) in red

Device ID: eaea0bcc-2970-41e1-8821-29be122a65b0:
Device ID: 3301af3b-a6fe-429e-8b01-c7b71249abdf:
Device ID: 11d4bcfe-bde2-42bd-8ebc-43ee77012480:
Device ID: e785cb18-96e1-4215-931a-82a731d2ee5a:
Device ID: 36816c9e-3b69-4b8c-b9f7-150b0edf94db:
Device ID: 5fe079a9-6e53-4a9d-b974-eca5d0916632:
Device ID: 0b011106-e5fe-4202-92bd-c89abd042249:
Device ID: b5b36857-0f47-4df9-8c8a-0ff431875b18:
Device ID: 1607ca61-c966-483d-bbfb-d97027d507c1:
Device ID: 79d9a5cb-3704-4a21-aedf-5989c70baed0:
Device ID: e3a7cfea-c281-46fe-8758-0bf2388181c0:
Device ID: e194deb4-afb0-4c83-aab2-71fcd13ca4e8:

- 48% of Device IDs are in bad quality

Broken Device ID (if only NaN values) in lilac

Device ID: a82a9f13-4ec0-45bd-a218-4e2cc4ca11bb:
Device ID: f97fcfd4-a7a8-4839-958a-334d8c02566c:

- 8% of Device IDs are broken

Weissglas Analysis

1. **List of Device ID that had NaN values at one point**

```
device_id
ecadcf7b-cf9e-477c-a56d-99d9472c4072 9589
18def07f-6077-4543-a572-982cd63ef262 9555
827fd8d9-b94a-414c-aa38-0bb6d7880527 9502
632c0d31-1145-49b7-b327-952ab64369d2 9478
a1f343aa-dbbd-4b7e-ac42-58ee4bfffd06 9418
6d43f154-1009-470a-95a2-f40fe4b8a204 9275
2a508d99-73fc-4992-8de0-f452a979f047 9105
7d1d7a97-2d16-4ccd-aae6-5cf8ffc2afb7 9053
a7bbd831-d444-4011-b6df-37b47b8e218d 8829
8d2aba9c-3983-4227-a8ff-eac6143ee60e 8580
ea6180ea-e2e3-476e-8e87-c1ae0abb504f 8509
8ddb5dd3-0822-485e-aebb-973df12c9dc9 8231
2e7c7f54-ff9c-4464-a1aa-d247d30333db 8194
69715520-6a46-417c-9e78-7e71e90389d7 8189
f2aaa75a-0ea0-4e4a-8363-7c7a98c160d9 8071
d4a9fa6b-880c-4d5d-9650-dff9f10c8a5f 8055
a54a033f-6571-4319-adfe-52e6916be435 7756
195f9fb4-4486-4b3d-bb41-8a9d7715a931 7668
2e98f08e-3cfb-4594-9f9c-133fab16f7ca 7276
e92be93e-2221-4d7f-bd29-0177c7608c88 4310
286bb721-9cb2-448a-9c2f-aadd4a1bf2d6 1201
```

2. **From which time frame were they broken? (UTC time)**

```
Oldest broken timestamp 2020-01-01 00:00:46+00:00 -> 195f9fb4-4486-4b3d-bb41-
8a9d7715a931

Newest broken timestamp 2023-11-30 22:56:12+00:00 -> 632c0d31-1145-49b7-b327-
952ab64369d2
```

Detailed Analysis Weissglas:

Which Device ID is it and from when until when was it broken?

DataFrame df_1 - Device ID: ea6180ea-e2e3-476e-8e87-c1ae0abb504f:

	Start Date	End Date
0	2020-01-01	2020-10-14
1	2020-10-19	2020-11-10
2	2020-11-18	2020-11-23
3	2020-11-26	2020-12-08
4	2020-12-11	2022-04-12
5	2022-04-15	2022-04-15
6	2022-04-18	2022-05-03
7	2022-05-06	2022-05-16
8	2022-05-21	2022-06-05
9	2022-06-10	2022-06-11
10	2022-06-14	2022-06-18

- Last working day 2022-06-18
- Percentage of NaN values: 20.71%

==========

DataFrame df_2 - Device ID: 632c0d31-1145-49b7-b327-952ab64369d2:

	Start Date	End Date
0	2020-01-01	2020-10-03
1	2020-10-07	2020-10-19
2	2020-10-22	2020-10-23
3	2020-10-28	2022-01-26
4	2022-01-29	2022-03-09
5	2022-03-12	2022-05-30
6	2022-06-02	2022-10-01
7	2022-10-04	2023-06-24
8	2023-06-27	2023-11-30

- Percentage of NaN values: 14.37%

==========

DataFrame df_3 - Device ID: 69715520-6a46-417c-9e78-7e71e90389d7:

	Start Date	End Date
0	2020-01-01	2020-10-06
1	2020-10-09	2020-10-09
2	2020-10-13	2020-11-13
3	2020-11-16	2020-11-23
4	2020-11-26	2021-06-17

- Last working day 2021-06-17
- Percentage of NaN values: 34.46%

==========

DataFrame df_4 - Device ID: 2e98f08e-3cfb-4594-9f9c-133fab16f7ca:

	Start Date	End Date
0	2020-01-01	2020-07-01
1	2020-07-05	2020-08-21
2	2020-08-24	2020-10-17
3	2020-10-20	2020-10-21
4	2020-10-24	2020-10-26
5	2020-10-30	2020-11-03
6	2020-11-06	2020-11-08
7	2020-11-13	2020-11-18
8	2020-11-21	2020-11-22
9	2020-11-25	2020-12-02
10	2020-12-05	2021-06-16

- Last working day 2021-06-16
- Percentage of NaN values: 32.58%

==========

DataFrame df_5 - Device ID: 6d43f154-1009-470a-95a2-f40fe4b8a204:

	Start Date	End Date
0	2020-01-01	2020-10-01
1	2020-10-07	2020-10-15
2	2020-10-18	2020-10-27
3	2020-10-30	2020-11-01
4	2020-11-04	2020-11-05
5	2020-11-08	2020-11-08
6	2020-11-11	2021-03-12
7	2021-03-16	2022-02-10
8	2022-02-13	2022-07-14
9	2022-07-18	2023-02-04
10	2023-02-07	2023-05-01
11	2023-05-04	2023-11-30

- Percentage of NaN values: 14.35%

==========

DataFrame df_6 - Device ID: 18def07f-6077-4543-a572-982cd63ef262:

	Start Date	End Date
0	2020-01-01	2020-10-04
1	2020-10-09	2020-11-12
2	2020-11-15	2023-11-10
3	2023-11-13	2023-11-20

- Last working day 2023-11-20
- Percentage of NaN values: 14.06%

==========

DataFrame df_7 - Device ID: a1f343aa-dbbd-4b7e-ac42-58ee4bfffd06:

	Start Date	End Date
0	2020-01-01	2020-10-22
1	2020-10-25	2020-11-16
2	2020-11-21	2020-11-23
3	2020-11-26	2021-03-24
4	2021-03-27	2021-05-08
5	2021-05-11	2021-05-14
6	2021-05-17	2021-07-20
7	2021-07-23	2021-10-15
8	2021-10-18	2022-03-04
9	2022-03-07	2022-05-12
10	2022-05-15	2022-06-24
11	2022-06-27	2023-11-30

- Percentage of NaN values: 14.11%

==========

DataFrame df_8 - Device ID: 2e7c7f54-ff9c-4464-a1aa-d247d30333db:

	Start Date	End Date
0	2020-01-01	2020-08-01
1	2020-08-04	2020-08-08
2	2020-08-11	2020-08-14
3	2020-08-17	2020-10-02
4	2020-10-05	2020-10-05
5	2020-10-08	2020-10-15
6	2020-10-18	2020-10-18
7	2020-10-23	2020-10-30
8	2020-11-02	2020-11-12
9	2020-11-15	2020-11-19
10	2020-11-24	2020-11-25
11	2020-11-28	2021-04-14

- Last working day 2021-04-14
- Percentage of NaN values: 40.73%

==========

DataFrame df_9 - Device ID: 2a508d99-73fc-4992-8de0-f452a979f047:

	Start Date	End Date
0	2020-01-01	2020-10-06
1	2020-10-11	2020-10-11
2	2020-10-15	2020-10-23
3	2020-10-26	2022-06-17
4	2022-06-20	2023-11-27

- Last working day 2023-11-27
- Percentage of NaN values: 13.97%

==========

DataFrame df_10 - Device ID: 827fd8d9-b94a-414c-aa38-0bb6d7880527:

	Start Date	End Date
0	2020-01-01	2020-10-29
1	2020-11-01	2020-11-22
2	2020-11-25	2021-03-24
3	2021-03-27	2021-05-08
4	2021-05-11	2022-03-04
5	2022-03-07	2022-04-17
6	2022-04-20	2022-08-02
7	2022-08-05	2023-11-30

- Percentage of NaN values: 14.06%

==========

DataFrame df_11 - Device ID: a7bbd831-d444-4011-b6df-37b47b8e218d:

	Start Date	End Date
0	2020-01-01	2020-10-07
1	2020-10-10	2020-10-10
2	2020-10-13	2020-10-25
3	2020-10-28	2020-11-07
4	2020-11-10	2020-11-11
5	2020-11-17	2022-07-25
6	2022-07-28	2022-10-17

- Last working day 2022-10-17
- Percentage of NaN values: 18.40%

==========

DataFrame df_12 - Device ID: d4a9fa6b-880c-4d5d-9650-dff9f10c8a5f:

	Start Date	End Date
0	2020-01-01	2020-04-27
1	2020-05-13	2020-10-02
2	2020-10-05	2020-10-05
3	2020-10-10	2020-11-18
4	2020-11-22	2022-04-06

- Last working day 2022-04-06
- Percentage of NaN values: 21.38%

==========

DataFrame df_13 - Device ID: ecadcf7b-cf9e-477c-a56d-99d9472c4072:

	Start Date	End Date
0	2020-01-01	2020-10-17
1	2020-10-20	2020-11-07
2	2020-11-10	2022-01-05
3	2022-01-08	2023-10-13

- Percentage of NaN values: 14.91%

==========

DataFrame df_14 - Device ID: f2aaa75a-0ea0-4e4a-8363-7c7a98c160d9:

	Start Date	End Date
0	2020-01-01	2020-10-10
1	2020-10-13	2020-10-28
2	2020-11-04	2020-11-07
3	2020-11-10	2020-11-12
4	2020-11-15	2020-11-23
5	2020-11-26	2021-03-29

- Last working day 2021-03-29
- Percentage of NaN values: 39.38%

==========

DataFrame df_15 - Device ID: 7d1d7a97-2d16-4ccd-aae6-5cf8ffc2afb7:

	Start Date	End Date
0	2020-01-01	2020-09-25
1	2020-09-29	2020-10-01
2	2020-10-07	2020-10-31
3	2020-11-03	2020-11-17
4	2020-11-20	2020-11-20
5	2020-11-23	2020-11-23
6	2020-11-26	2021-03-29
7	2021-04-16	2021-05-04
8	2021-05-07	2021-07-14
9	2021-07-17	2022-03-23
10	2022-03-26	2022-05-14
11	2022-05-17	2022-07-26
12	2022-08-10	2022-11-11
13	2022-11-14	2022-12-13

- Last working day 2022-12-13
- Percentage of NaN values: 18.80%

==========

DataFrame df_16 - Device ID: 8ddb5dd3-0822-485e-aebb-973df12c9dc9:

	Start Date	End Date
0	2020-01-01	2020-07-02
1	2020-07-06	2020-10-12
2	2020-10-18	2020-10-25
3	2020-10-28	2020-11-05
4	2020-11-08	2020-11-22
5	2020-11-25	2021-03-29

- Last working day 2021-03-29
- Percentage of NaN values: 40.41%

==========

DataFrame df_17 - Device ID: 8d2aba9c-3983-4227-a8ff-eac6143ee60e:

	Start Date	End Date
0	2020-01-01	2020-09-29
1	2020-10-02	2020-10-03
2	2020-10-06	2020-10-15
3	2020-10-18	2020-10-19
4	2020-10-22	2020-10-23
5	2020-10-27	2020-10-31
6	2020-11-04	2020-11-08
7	2020-11-11	2020-11-15
8	2020-11-18	2020-11-21
9	2020-11-24	2022-02-21
10	2022-02-24	2022-03-30

- Last working day 2022-03-30
- Percentage of NaN values: 22.90%

==========

DataFrame df_18 - Device ID: a54a033f-6571-4319-adfe-52e6916be435:

	Start Date	End Date
0	2020-01-01	2020-07-01
1	2020-07-05	2020-10-02
2	2020-10-06	2020-10-12
3	2020-10-15	2020-10-30
4	2020-11-02	2020-11-19
5	2020-11-23	2020-11-23
6	2020-11-26	2021-03-28
7	2021-04-09	2021-05-04

8 2021-05-07 2021-06-30
9 2021-07-03 2021-08-13
10 2021-08-16 2021-10-11
11 2021-10-14 2021-10-16
12 2021-10-19 2021-12-06
13 2021-12-09 2022-01-13
14 2022-01-22 2022-01-28
15 2022-03-28 2022-03-28
16 2022-04-19 2022-04-19

- Last working day 2022-04-19
- Percentage of NaN values: 24.97%

==========

DataFrame df_19 - Device ID: 195f9fb4-4486-4b3d-bb41-8a9d7715a931:
Start Date End Date
0 2020-01-01 2020-07-27

- Last working day 2020-07-27
- Percentage of NaN values: 81.45%

==========

DataFrame df_20 - Device ID: e92be93e-2221-4d7f-bd29-0177c7608c88:
Start Date End Date
0 2020-01-01 2020-04-08

- No working day, the Device ID only consist of NaN values
- Percentage of NaN values: 100.00%

==========

DataFrame df_21 - Device ID: 286bb721-9cb2-448a-9c2f-aadd4a1bf2d6:
Start Date End Date
0 2020-01-01 2020-01-03
1 2020-01-06 2020-01-15
2 2020-01-18 2020-01-19
3 2020-01-30 2020-01-30
4 2020-03-23 2020-03-24
5 2020-03-27 2020-04-02
6 2020-04-11 2020-04-23
7 2020-05-02 2020-06-10
8 2020-07-07 2020-07-08
9 2020-07-20 2020-07-20
10 2020-09-07 2020-09-13
11 2020-09-17 2020-09-22
12 2020-09-25 2020-09-27
13 2020-10-02 2020-10-02
14 2020-10-09 2020-10-09
15 2020-10-17 2020-10-17
16 2020-11-12 2020-11-12
17 2020-12-18 2020-12-18
18 2020-12-27 2020-12-27
19 2020-12-30 2020-12-31
20 2021-01-07 2021-01-07
21 2021-01-12 2021-01-13
22 2021-01-18 2021-01-18
23 2021-01-28 2021-02-01
24 2021-02-04 2021-02-05
25 2021-02-08 2021-02-08
26 2021-03-03 2021-03-04

- Last working day 2021-03-04
- Percentage of NaN values: 41.23%

==========

- **There is no Device ID that has no NaN values**

- **Of the Weissglas dataset, there are 20.5% NaN values**

Good Quality Device ID (if last day = 30.11.2023) in green

Device ID: 632c0d31-1145-49b7-b327-952ab64369d2:
Device ID: 6d43f154-1009-470a-95a2-f40fe4b8a204:
Device ID: a1f343aa-dbbd-4b7e-ac42-58ee4bfffd06:
Device ID: 827fd8d9-b94a-414c-aa38-0bb6d7880527:

- 19% of Device IDs are in good quality

Medium Quality Device ID (if last day in 2023) in yellow

Device ID: 18def07f-6077-4543-a572-982cd63ef262:
Device ID: 2a508d99-73fc-4992-8de0-f452a979f047:
Device ID: ecadcf7b-cf9e-477c-a56d-99d9472c4072:

- 14% of Device IDs are in medium quality

Poor Quality Device ID (if last day before 2023) in red

Device ID: ea6180ea-e2e3-476e-8e87-c1ae0abb504f:
Device ID: 69715520-6a46-417c-9e78-7e71e90389d7:
Device ID: 2e98f08e-3cfb-4594-9f9c-133fab16f7ca:
Device ID: 2e7c7f54-ff9c-4464-a1aa-d247d30333db:
Device ID: a7bbd831-d444-4011-b6df-37b47b8e218d:
Device ID: d4a9fa6b-880c-4d5d-9650-dff9f10c8a5f:
Device ID: f2aaa75a-0ea0-4e4a-8363-7c7a98c160d9:
Device ID: 7d1d7a97-2d16-4ccd-aae6-5cf8ffc2afb7:
Device ID: 8ddb5dd3-0822-485e-aebb-973df12c9dc9:
Device ID: 8d2aba9c-3983-4227-a8ff-eac6143ee60e:
Device ID: a54a033f-6571-4319-adfe-52e6916be435:
Device ID: 195f9fb4-4486-4b3d-bb41-8a9d7715a931:
Device ID: 286bb721-9cb2-448a-9c2f-aadd4a1bf2d6:

- 62% of Device IDs are in bad quality

Broken Device ID (if only NaN values) in lilac

Device ID: e92be93e-2221-4d7f-bd29-0177c7608c88:

- 4% of Device IDs are broken

Braunglas Analysis

1. **List of Device ID that had NaN values at one point**

device_id

473a8148-3001-42ec-946e-55d479bfc9c4 13430
4f48bac6-9d0e-4879-93ad-5bf39b4c5915 13012
624e62e7-2b0b-43dc-a992-77ab95adbbb8 12804
f5afab11-faaa-4bf1-8d4f-d76bdf5381f4 12341
fa37f819-027b-4f6e-8e7d-1c80488f036f 11974
ae87483e-d1ed-4169-a05b-5f53d38c7185 11403
bd1f5d39-0361-4717-9054-845ac2fa33bd 11245
c737f0e5-1838-46ea-8806-89935bd3a560 11170
1e8d1b09-d186-495e-bd1f-cb06afdd5b21 9047
72b408a3-5924-4c60-8f7f-ff534de140fb 8594
75ba05c7-3c77-4160-a72d-8dc15efee2c5 5721
3dd2b101-9f8d-41fa-9dc3-823729aefabb 5711
d8a3a3ca-39d7-46a2-9c50-0b5bc1717979 5008
04c14b60-34a4-40ab-aae2-bf4d616eb0d6 1696
7cfecc22-d53c-45b4-8eb2-cb8219ca531e 925
ba09e800-34d1-4d0d-8b2b-361aabe93648 782

2. **From which time frame were they broken? (UTC time)**

Oldest broken timestamp 2020-01-01 00:06:57+00:00 -> d8a3a3ca-39d7-46a2-9c50-0b5bc1717979

Newest broken timestamp 2023-12-01 21:41:59+00:00 -> 624e62e7-2b0b-43dc-a992-77ab95adbbb8

Detailed Analysis Weissglas:

Which Device ID is it and from when until when was it broken?

DataFrame df_1 - Device ID: 4f48bac6-9d0e-4879-93ad-5bf39b4c5915:

	Start Date	End Date
0	2020-01-01	2020-09-24
1	2020-09-29	2020-10-15
2	2020-10-20	2020-11-20
3	2020-11-23	2021-03-29
4	2021-04-16	2021-05-03
5	2021-05-07	2022-03-26
6	2022-03-29	2022-07-26
7	2022-08-10	2023-04-29
8	2023-05-10	2023-07-06
9	2023-07-09	2023-08-27
10	2023-08-30	2023-12-01

- Percentage of NaN values: 14.60%

==========

DataFrame df_2 - Device ID: 1e8d1b09-d186-495e-bd1f-cb06afdd5b21:

	Start Date	End Date
0	2020-01-01	2020-10-03
1	2020-10-06	2020-10-08
2	2020-10-11	2020-10-18
3	2020-10-21	2020-10-21
4	2020-10-24	2022-04-06

- Last working day 2022-04-06
- Percentage of NaN values: 22.74%

==========

DataFrame df_3 - Device ID: 473a8148-3001-42ec-946e-55d479bfc9c4:

	Start Date	End Date
0	2020-01-01	2020-10-13
1	2020-10-16	2020-10-17
2	2020-10-20	2020-11-11
3	2020-11-14	2020-11-19
4	2020-11-22	2021-05-15
5	2021-05-18	2021-12-27
6	2021-12-30	2022-10-28
7	2022-10-31	2023-05-09
8	2023-05-12	2023-12-01

- Percentage of NaN values: 14.10%

==========

DataFrame df_4 - Device ID: 75ba05c7-3c77-4160-a72d-8dc15efee2c5:

	Start Date	End Date
0	2020-01-01	2020-06-25
1	2020-06-28	2020-10-10
2	2020-10-14	2020-10-23
3	2020-10-27	2020-11-13
4	2020-11-16	2020-11-18
5	2020-11-21	2021-03-29
6	2021-04-09	2021-04-22
7	2021-04-25	2021-06-11

- Last working day 2021-06-11
- Percentage of NaN values: 33.73%

==========

DataFrame df_5 - Device ID: c737f0e5-1838-46ea-8806-89935bd3a560:

	Start Date	End Date
0	2020-01-01	2020-10-02
1	2020-10-07	2020-10-16
2	2020-10-19	2020-10-27
3	2020-10-31	2020-11-20
4	2020-11-23	2021-12-21
5	2021-12-24	2022-11-23

- Last working day 2022-11-23
- Percentage of NaN values: 18.00%

==========

DataFrame df_6 - Device ID: ba09e800-34d1-4d0d-8b2b-361aabe93648:

	Start Date	End Date
0	2020-01-01	2020-03-20

- No working day, the Device ID only consist of NaN values
- Percentage of NaN values: 100.00%

==========

DataFrame df_7 - Device ID: d8a3a3ca-39d7-46a2-9c50-0b5bc1717979:

	Start Date	End Date
0	2020-01-01	2020-07-05
1	2020-07-08	2020-07-23
2	2020-07-26	2020-11-15
3	2020-11-18	2020-11-19
4	2020-11-22	2021-03-30

- Last working day 2021-03-30
- Percentage of NaN values: 40.35%

==========

DataFrame df_8 - Device ID: 04c14b60-34a4-40ab-aae2-bf4d616eb0d6:

	Start Date	End Date
0	2020-01-01	2020-02-10
1	2020-02-13	2020-02-20
2	2020-02-24	2020-03-12
3	2020-03-15	2020-04-12
4	2020-04-17	2020-05-24
5	2020-05-27	2020-06-12
6	2020-06-24	2020-06-27
7	2020-07-01	2020-07-02
8	2020-07-13	2020-07-13
9	2020-07-16	2020-07-16
10	2020-07-20	2020-07-20
11	2020-07-23	2020-07-23
12	2020-07-27	2020-08-01
13	2020-08-11	2020-08-19
14	2020-08-25	2020-08-29
15	2020-09-05	2020-09-06
16	2020-09-09	2020-09-14
17	2020-09-19	2020-09-26
18	2020-10-28	2020-10-28
19	2020-11-02	2020-11-02
20	2020-11-05	2020-11-05
21	2020-11-11	2020-11-12
22	2020-11-16	2020-11-19
23	2020-11-22	2020-11-22
24	2020-11-26	2020-11-27
25	2020-12-02	2020-12-09
26	2020-12-12	2020-12-18
27	2020-12-27	2020-12-30
28	2021-01-02	2021-01-02
29	2021-01-05	2021-01-10
30	2021-01-17	2021-01-17
31	2021-01-20	2021-01-21
32	2021-01-24	2021-01-29
33	2021-02-01	2021-02-01
34	2021-02-08	2021-02-08
35	2021-02-14	2021-02-16
36	2021-02-21	2021-02-22
37	2021-02-27	2021-03-01
38	2021-03-05	2021-03-05
39	2021-03-08	2021-03-13
40	2021-03-16	2021-03-20
41	2021-03-23	2021-03-27

- Last working day 2021-03-27
- Percentage of NaN values: 37.43%

==========

DataFrame df_9 - Device ID: 624e62e7-2b0b-43dc-a992-77ab95adbbb8:

	Start Date	End Date
0	2020-01-01	2020-09-28
1	2020-10-01	2020-10-28
2	2020-11-01	2020-11-02
3	2020-11-05	2020-11-05
4	2020-11-08	2020-11-25
5	2020-11-28	2021-01-15

6	2021-01-18	2021-03-11
7	2021-03-15	2021-10-24
8	2021-10-27	2021-10-27
9	2021-10-30	2021-11-03
10	2021-11-06	2022-01-30
11	2022-02-02	2022-08-03
12	2022-08-07	2023-12-01

- Percentage of NaN values: 2.25%

==========

DataFrame df_10 - Device ID: 7cfecc22-d53c-45b4-8eb2-cb8219ca531e:

	Start Date	End Dat
0	2020-06-22	2020-08-03
1	2020-08-06	2020-08-29
2	2020-09-05	2020-09-06
3	2020-09-14	2020-09-18

- Last working day 2020-09-18
- Percentage of NaN values: 12.01%

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DataFrame df_11 - Device ID: fa37f819-027b-4f6e-8e7d-1c80488f036f:

	Start Date	End Date
0	2020-06-17	2020-10-03
1	2020-10-07	2020-10-08
2	2020-10-11	2020-11-05
3	2020-11-10	2020-11-14
4	2020-11-17	2020-11-19
5	2020-11-22	2021-03-24
6	2021-03-27	2023-12-01

- Percentage of NaN values: 2.21%

==========

DataFrame df_12 - Device ID: bd1f5d39-0361-4717-9054-845ac2fa33bd:

OBJ	Start Date OBJ OBJ	End Date
0 OBJ	2020-06-17	OBJ 2020-10-10
1	OBJ 2020-10-13	OBJ 2020-10-20
2	OBJ 2020-10-23 OBJ	2021-10-18
3	OBJ 2021-10-21 OBJ	2022-04-17
4	OBJ 2022-04-20	OBJ 2022-04-25
5 OBJ	2022-04-28 OBJ	2022-05-30
6	OBJ 2022-06-02 OBJ	2022-07-31
7	OBJ 2022-08-03	2022-08-29
8	OBJ 2022-09-01	2022-09-03
9	OBJ 2022-09-07	2022-10-13
10	OBJ 2022-10-16	2022-11-27
11 OBJ	2022-12-01	2022-12-08
12 OBJ	2022-12-13	2023-01-01
13 OBJ	2023-01-06	2023-01-08
14 OBJ	2023-01-12	2023-01-12
15 OBJ	2023-01-15	2023-01-22
16	2023-01-25	2023-03-05
17	2023-03-08	2023-03-14
18	2023-03-17	2023-03-22
19	2023-03-25	2023-03-27
20	2023-03-30	2023-04-10
21	2023-04-13	2023-05-05
22	2023-05-08	2023-07-30

23	2023-08-02	2023-08-03
24	2023-08-06	2023-09-16
25	2023-09-19	2023-09-24
26	2023-09-27	2023-10-01
27	2023-10-04	2023-11-04
28	2023-11-08	2023-11-17
29	2023-11-20	2023-12-01

- Percentage of NaN values: 2.21%

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DataFrame df_13 - Device ID: f5afab11-faaa-4bf1-8d4f-d76bdf5381f4:

	Start Date	End Date
0	2020-06-17	2020-07-01
1	2020-07-04	2020-10-05
2	2020-10-08	2020-11-02
3	2020-11-05	2020-11-07
4	2020-11-11	2020-11-23
5	2020-11-26	2023-11-04

- Last working day 2023-11-04
- Percentage of NaN values: 2.29%

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DataFrame df_14 - Device ID: 3dd2b101-9f8d-41fa-9dc3-823729aefabb:

	Start Date	End Date
0	2020-06-17	2020-08-28
1	2020-08-31	2020-09-28
2	2020-10-02	2020-10-05
3	2020-10-08	2020-10-09
4	2020-10-12	2020-10-12
5	2020-10-16	2020-10-17
6	2020-10-20	2020-10-26
7	2020-10-30	2020-11-04
8	2020-11-08	2020-11-18
9	2020-11-21	2020-11-24
10	2020-11-27	2021-08-13
11	2021-08-16	2021-09-26

- Last working day 2021-09-26
- Percentage of NaN values: 2.21%

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DataFrame df_15 - Device ID: ae87483e-d1ed-4169-a05b-5f53d38c7185:

	Start Date	End Date
0	2020-06-17	2020-09-30
1	2020-10-03	2020-10-18
2	2020-10-21	2020-10-22
3	2020-10-25	2020-11-02
4	2020-11-05	2020-11-20
5	2020-11-23	2020-11-23
6	2020-11-26	2022-08-30
7	2022-09-03	2023-05-26

- Last working day 2023-05-26
- Percentage of NaN values: 2.23%

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DataFrame df_16 - Device ID: 72b408a3-5924-4c60-8f7f-ff534de140fb:

	Start Date	End Date
0	2020-06-17	2020-09-29
1	2020-10-03	2020-10-15

2	2020-10-20	2020-10-23
3	2020-10-26	2020-11-07
4	2020-11-10	2021-10-21
5	2021-10-24	2022-08-06
6	2022-08-10	2022-08-23

- Last working day 2022-08-23
- Percentage of NaN values: 2.22%

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- **There is no Device ID that has no NaN values**

- **Of the Weissglas dataset, there are 10.7% NaN values**

Good Quality Device ID (if last day = 01.12.2023) in green:

Device ID: 4f48bac6-9d0e-4879-93ad-5bf39b4c5915:
Device ID: 473a8148-3001-42ec-946e-55d479bfc9c4:
Device ID: 624e62e7-2b0b-43dc-a992-77ab95adbbb8:
Device ID: fa37f819-027b-4f6e-8e7d-1c80488f036f:
Device ID: bd1f5d39-0361-4717-9054-845ac2fa33bd:

- 31% of Device IDs are in medium quality

Medium Quality Device ID (if last day in 2023) in yellow:

Device ID: f5afab11-faaa-4bf1-8d4f-d76bdf5381f4:
Device ID: ae87483e-d1ed-4169-a05b-5f53d38c7185:

- 13% of Device IDs are in medium quality

Poor Quality Device ID (if last day before 2023) in red

Device ID: 1e8d1b09-d186-495e-bd1f-cb06afdd5b21:
Device ID: 75ba05c7-3c77-4160-a72d-8dc15efee2c5:
Device ID: c737f0e5-1838-46ea-8806-89935bd3a560:
Device ID: d8a3a3ca-39d7-46a2-9c50-0b5bc1717979:
Device ID: 04c14b60-34a4-40ab-aae2-bf4d616eb0d6:
Device ID: 7cfecc22-d53c-45b4-8eb2-cb8219ca531e:
Device ID: 3dd2b101-9f8d-41fa-9dc3-823729aefabb:
Device ID: 72b408a3-5924-4c60-8f7f-ff534de140fb:

- 50% of Device IDs are in medium quality

Broken Device ID (if only NaN values) in lilac

Device ID: ba09e800-34d1-4d0d-8b2b-361aabe93648:

- 6% of Device IDs are broken