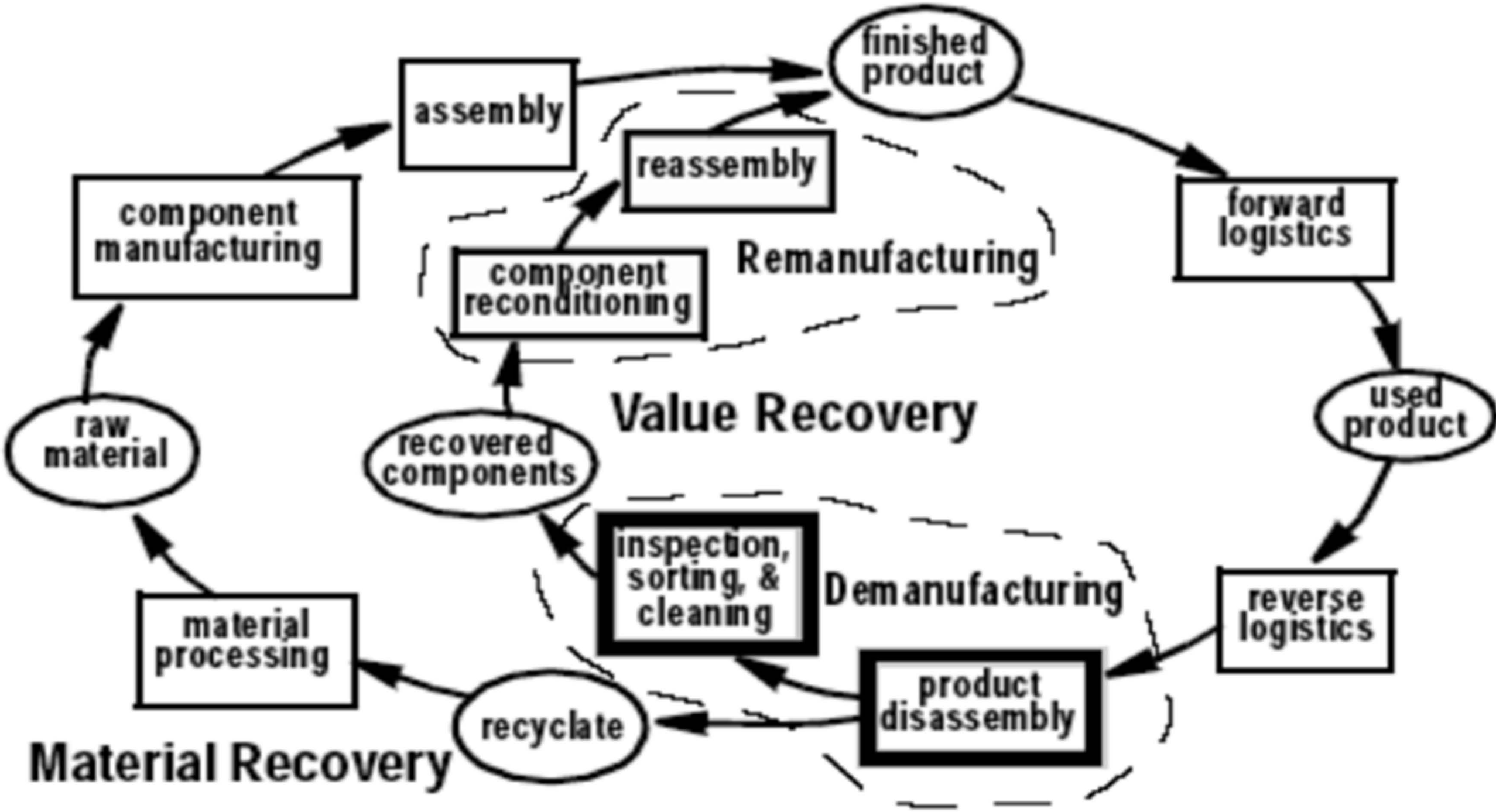
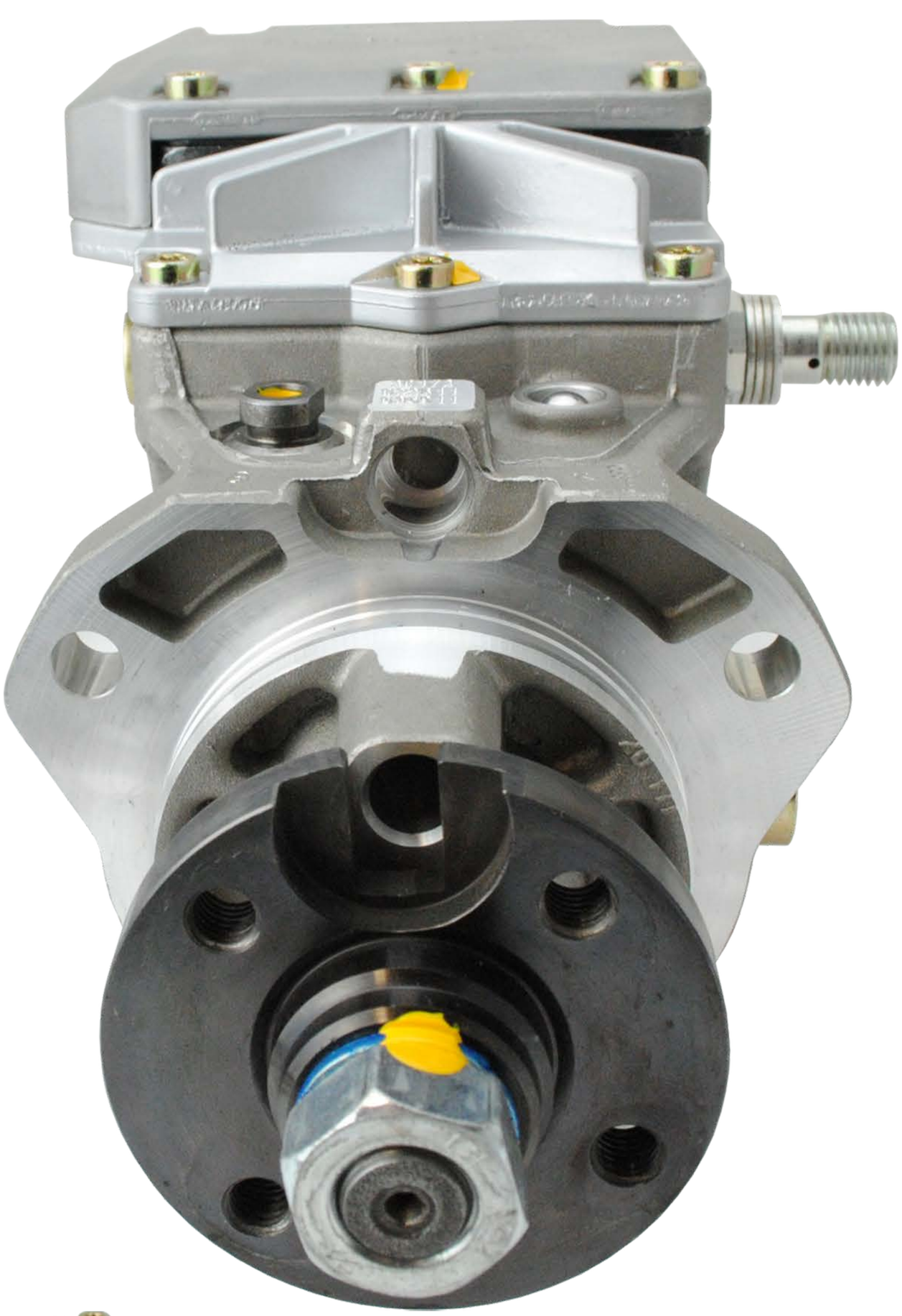
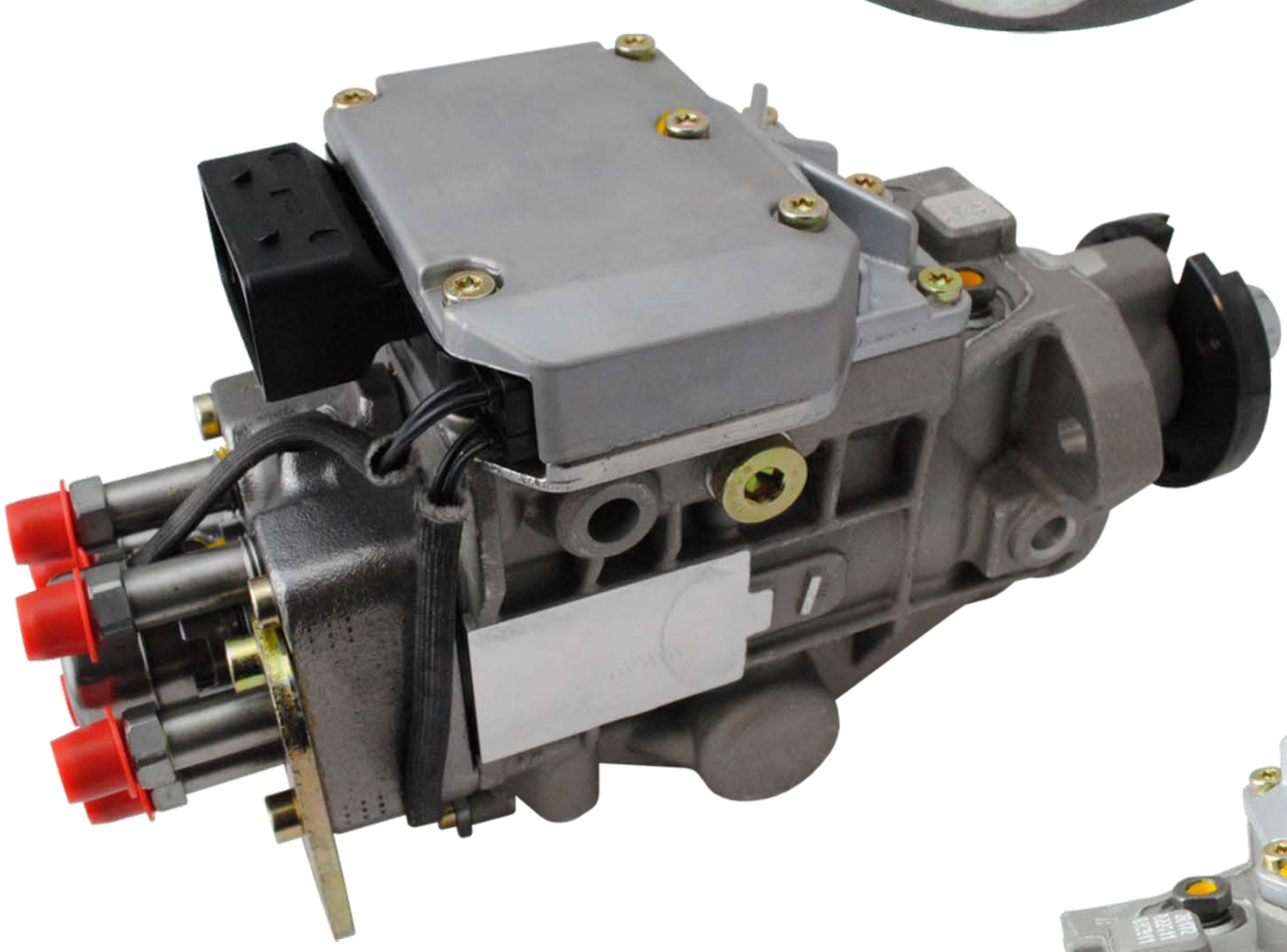
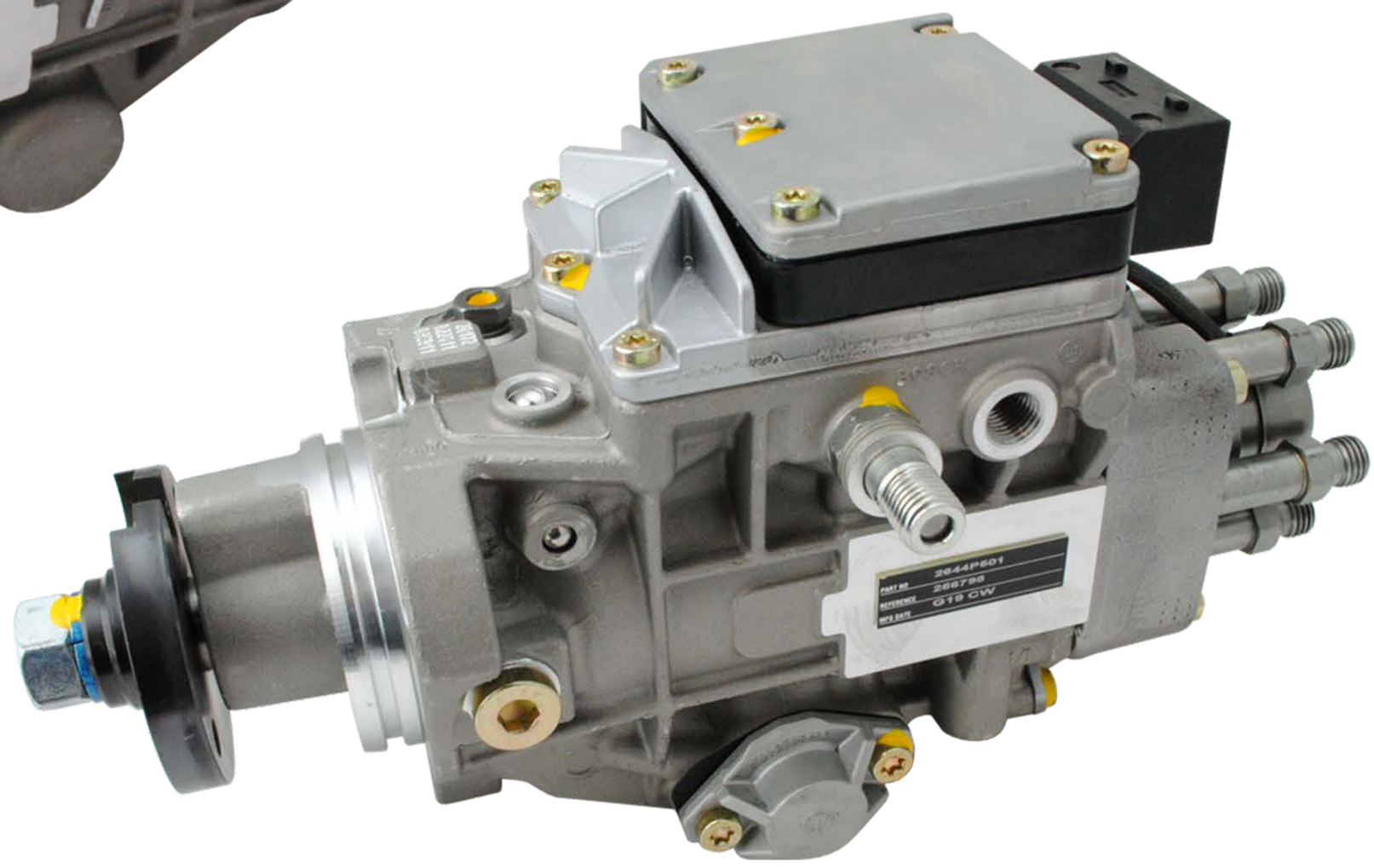

finished product
assembly
reassembly
component manufacturing
component reconditioning
Remanufacturing
forward logistics
raw material
recovered components
Value Recovery
used product
inspection, sorting, & cleaning
Demanufacturing
reverse logistics
material processing
product disassembly
recyclate
Material Recovery








2644P601
268798
G19 CW

# VE4/9F2200L12

**V** Distributor injection pump

**E** Axial-piston high-pressure pump
**R** Radial-piston high-pressure pump

**2…6** Number of high-pressure outlets

**8, 9, 10, 11, 12** Pump plunger diameter in mm

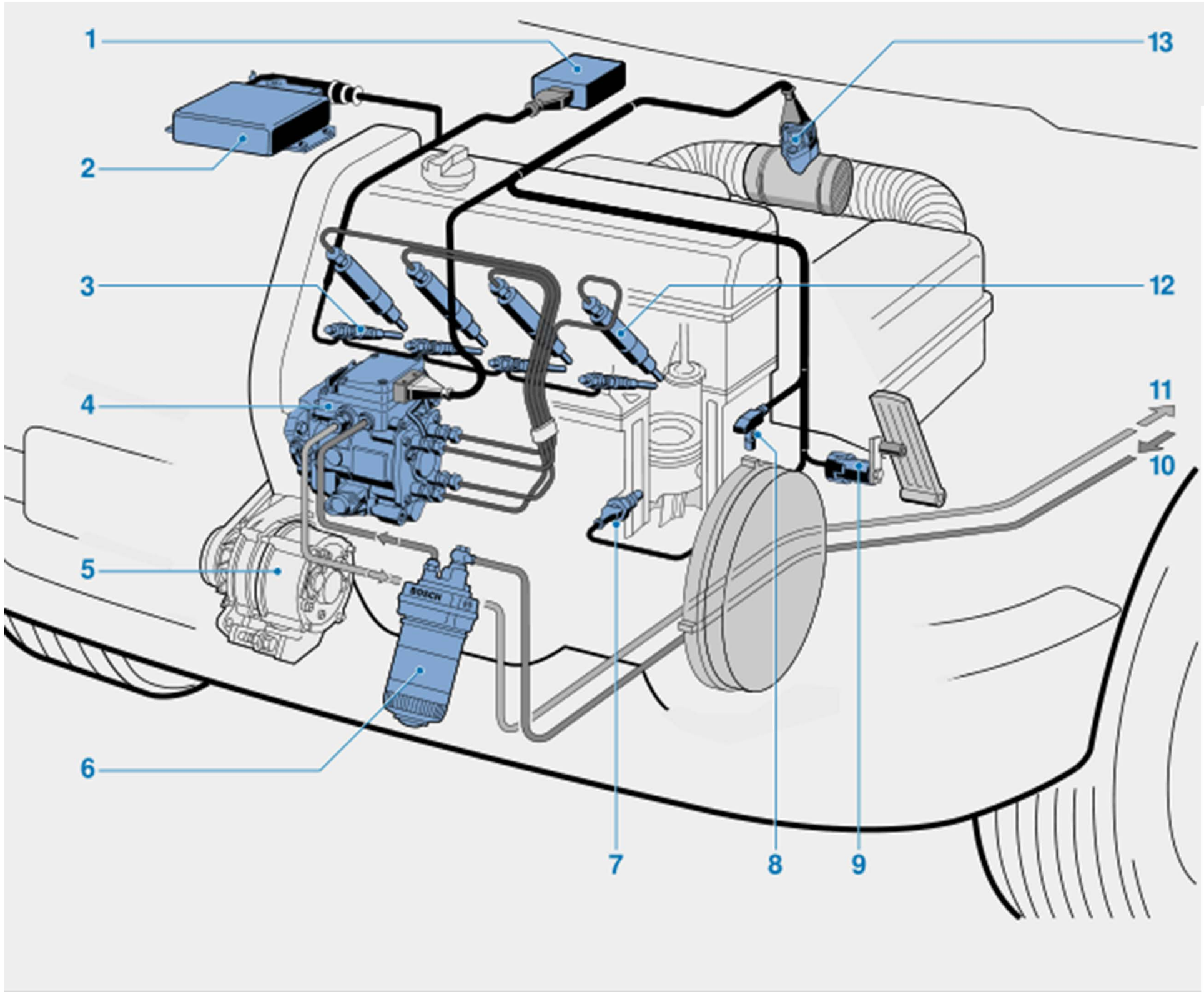
**F** Mechanical governor
**E** Electric actuator mechanism
**M** High-pressure solenoid valve

Upper nominal pump speed*

**L** Counterclockwise
**R** Clockwise
(View toward pump drive)

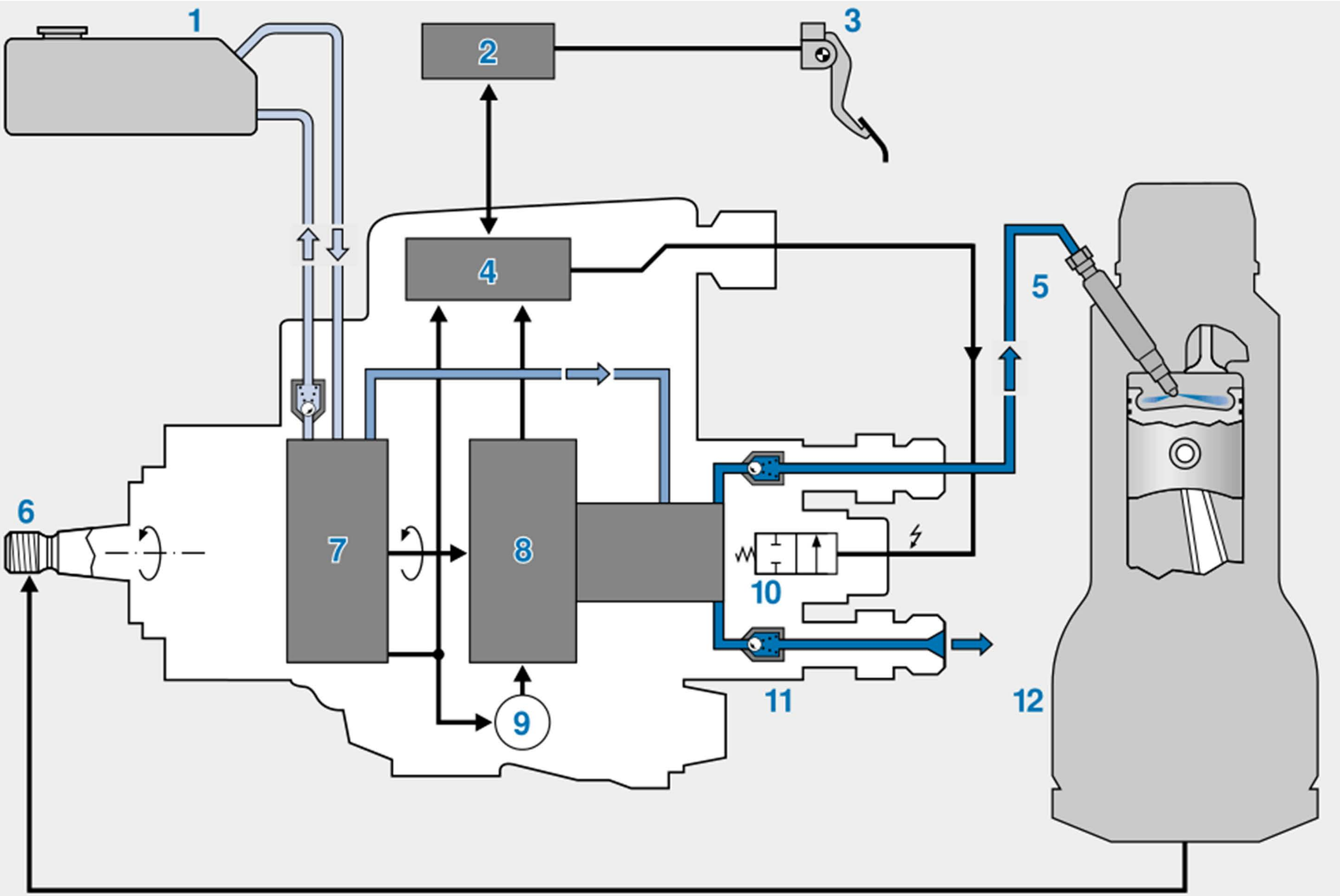
Type code

*Pump speed = half engine speed for four-stroke engine

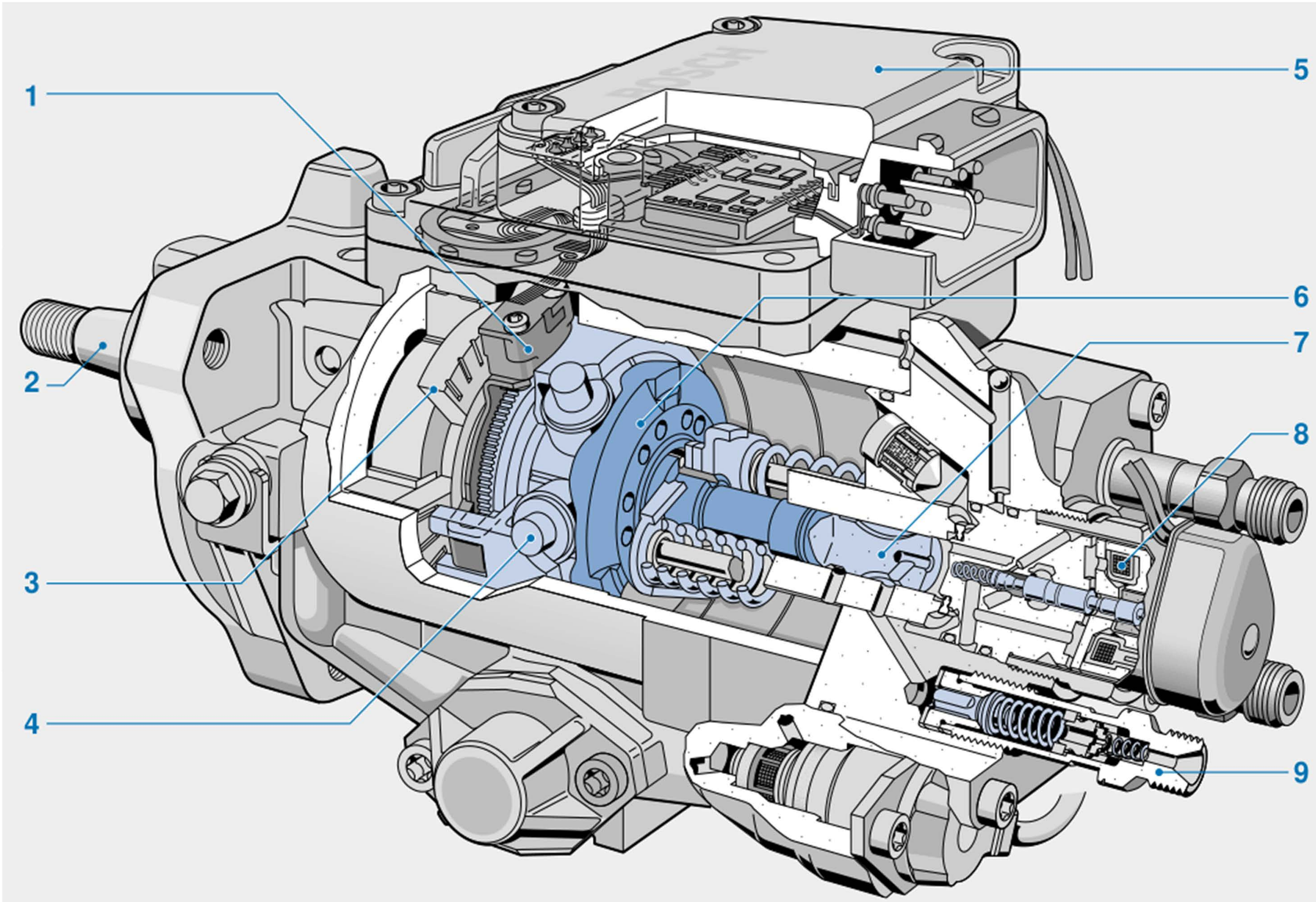



1 Type GZS glow control unit
2 Type MSG engine ECU
3 Type GSK sheathed-element glow plug
4 Type VP44 radial-piston distributor injection pump with Type PSG5 pump ECU
5 Alternator
6 Fuel filter
7 Engine-temperature sensor (in cooling system)
8 Crankshaft speed sensor
9 Pedal travel sensor
10 Fuel inlet
11 Fuel return
12 Nozzle-and-holder assembly
13 Air-mass meter

1 Fuel supply system (low-pressure stage)
2 Type MSG engine ECU
3 Accelerator pedal
4 Type PSG pump ECU
5 Nozzle-holder assembly
6 Pump drive shaft
7 Low-pressure stage (vane-type supply pump with pressure-control valve and overflow throttle valve)
8 High-pressure stage (axial or radial-piston high-pressure pump with fuel rail)
9 Timing device with timing-device solenoid valve and angle-of-rotation sensor
10 High-pressure solenoid valve
11 Delivery valve
12 Diesel engine



1 Angle-of-rotation sensor
2 Pump drive shaft
3 Support ring of vane-type supply pump
4 Roller ring
5 Pump control unit
6 Cam plate
7 Distributor plunger
8 High-pressure solenoid valve
9 High-pressure outlet



Automotive Spare Parts

Direct Metal Laser Sintering

Re-manufacturing

**Metal 3D Printing**

**Circular Economy**

High quality & affordable

**Sustainability**

Prolong part life

## Single motion disassembly action

Action block shape and color: Hand Tool

| MOST index | Remove | Press/Pull | Tap/Strike | Cut | MOST index |
|---|---|---|---|---|---|
| | Hand, Spudger, Lever, Prybar, Plier, etc. | Hand, Spudger, Lever, Prybar, Plier, etc. | Hand, Hammer, etc. | Scissors, Pliers, Knife (up to 80cm cut), etc. | |
| | No fastener present. Parts are kept in place just by their own weight | Friction fits, Snap fits, Single turn knobs or lid, Buttons, Hinges, Electronic connectors, Adhesives, Zippers, Velcro's, etc. | Connectors requiring a short up-down tapping/striking motion (e.g. nails, washing machine bearings) | Electronic cables, wires, tighteners, surfaces to be cut using scissors/knife, etc. | |
| 1 | The part to be removed is light requiring mainly fingers action (indicatively F<5N) and without having to follow a specific controlled removal path | Light press/pull force required (indicatively F<5N), applied mainly using fingers action (also in case a tool is used) | Light tap (not strike), force required (indicatively F<5N), applied mainly using wrist action (also in case a tool is used) | Pliers: light grip force, no cut (e.g. holding in place wire for soldering)<br>Scissors: simple cut requiring light force (e.g. paper or fabric)<br>(No knife, no cutting pliers) | 1 |
| 3 | The weight of the part to be removed is moderate, requiring wrist/hand action (indicatively 5<F<20N) and/or having to follow a specific controlled removal path | Moderate press/pull force required (indicatively 5N<F<20N), applied mainly using wrist action (also in case a tool is used) | Moderate strike force required (indicatively 5N<F<20N), applied mainly using arm action using a hammer (not simple hand tap) | Pliers, Scissors, Knife: Moderate cutting force required (indicatively 5N<F<20N), applied using one hand and requiring one cut action | 3 |
| 6 | The part to be removed is heavy, requiring two hands action (indicatively F>20N) and/or having to follow a specific controlled removal path | High press/pull force required (indicatively F>20N), applied mainly using arm action (also in case a tool is used) | High strike force required (indicatively F>20N), applied mainly using arm action using a hammer (not simple hand tap) | Only Pliers: High cutting force required (indicatively F>20N), applied using one or two hands and requiring up to two cut actions | 6 |

## Multiple motion disassembly action

Action block shape and color: Hand Tool

| MOST index | Finger action | Wrist action | | | Arm action | | | | Power Tool | MOST index |
|---|---|---|---|---|---|---|---|---|---|---|
| | #Spins | #Turns | #Strokes | #Cranks | #Turns | | #Strokes | #Cranks | Std*Screw head diam | |
| | Fingers, Screw driver | Wrist, Hand screwdriver, Ratchet, T-wrench | Wrench | Wrench, Ratchet | Ratchet | T-Wrench, 2-Hands | Wrench | Wrench, Ratchet | Power screwdriver or wrench | |
| 1 | 1 | - | - | - | - | - | - | - | - | 1 |
| 3 | 2 | 1 | 1 | 1 | 1 | - | 1 | - | <6mm | 3 |
| 6 | 3 | 3 | 2 | 3 | 2 | 1 | - | 1 | <25mm | 6 |
| 10 | 8 | 5 | 3 | 5 | 4 | - | 2 | 2 | | 10 |
| 16 | 16 | 9 | 5 | 8 | 6 | 3 | 3 | 3 | | 16 |
| 24 | 25 | 13 | 8 | 11 | 9 | 6 | 4 | 5 | | 24 |
| 32 | 35 | 17 | 10 | 15 | 12 | 8 | 6 | 6 | | 32 |
| 42 | 47 | 23 | 13 | 20 | 15 | 11 | 8 | 8 | | 42 |
| 54 | 61 | 29 | 17 | 25 | 20 | 15 | 10 | 11 | | 54 |

*Standard screw (length holding threads is 1 to 2 times the head diameter)

# PRELIMINARY DISASSEMBLY MAP

FULL PUMP

LEGEND

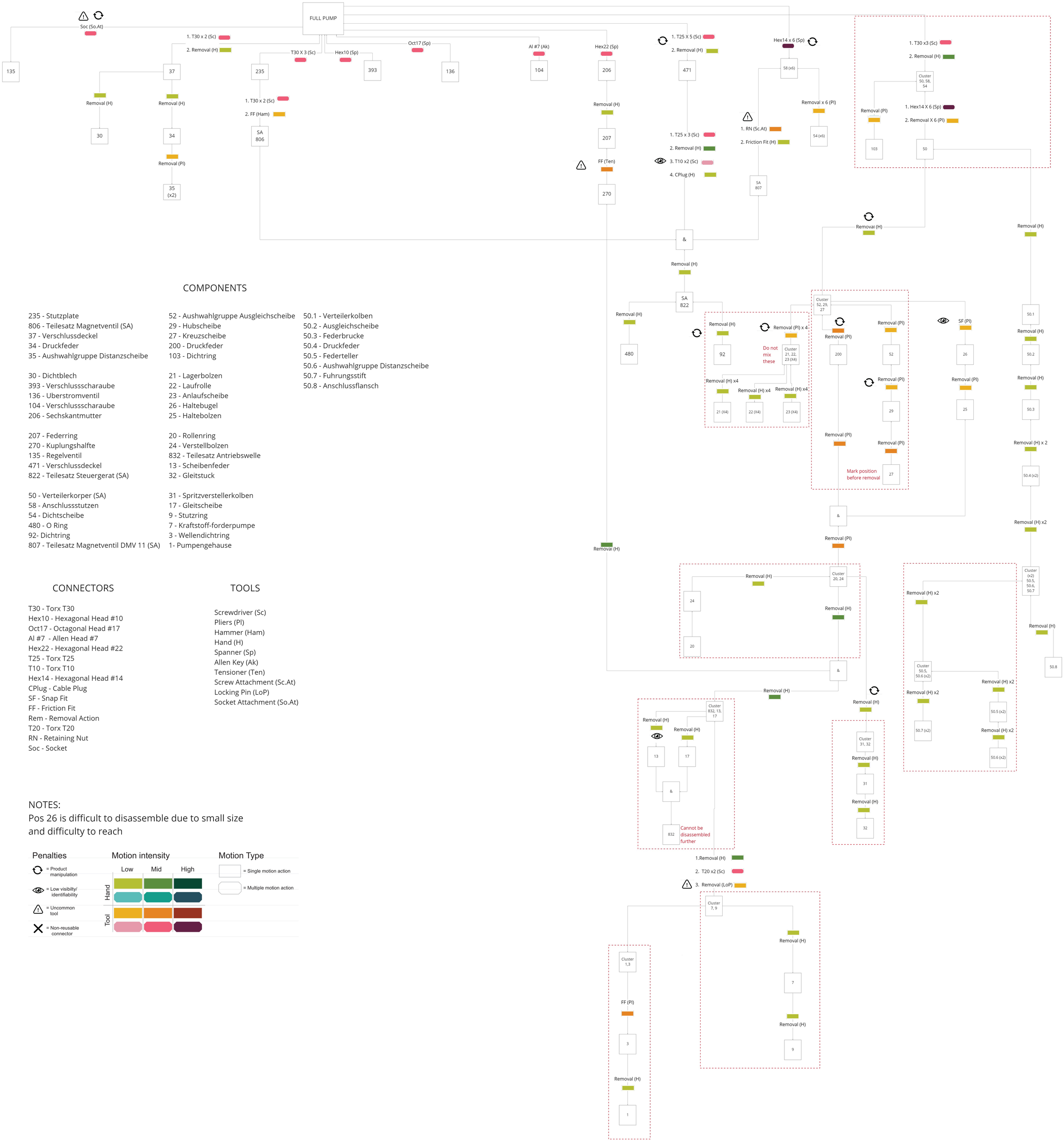
MOSTLY CORRECT POSITION

INCORRECT POSITION

- 3X Torx T30 → 235
- 2x Torx T30 → 424
- 5x Torx T25 Manipulation → 471
- 3x Torx T25 Hidden RIbbon Cable Soldered → 822 Subassembly (needs other removals)
- 3x Torx T30 Manipulation → 50 Subassembly
  - Hex Head #XX → 58
    - Tweezers / by hand → 54
    - Hammer Hand → 807 Subassembly
  - By hand → 21, 22, 23, 27, 29, 52 Cluster
    - Pliers → 200
      - Screwdriver → 26
        - Tweezers → 25
          - Hammer → 24
- 2x Torx T30 Manipulation → 37
  - By hand → 30, 35, 34 Cluster
- Allen Key #7 → 104
- Hex Head #XX → 136
- Special Screw → 135
- Hex #22 → 206
  - By hand → 207
    - Hammer → 270
- Allen Key #XX → 141
- Allen Head #XX → 393

24, 270, 104, 136, 135, 393, 141 → &

&
- By hand Manipulation → 832, 20, 13, 17 Cluster
  - Pliers → 9
    - By hand → 7
      - By hand → 1,3 Cluster
  - By hand → 31, 32 Cluster
  - By hand → 103




## COMPONENTS

235 - Stutzplate
806 - Teilesatz Magnetventil (SA)
37 - Verschlussdeckel
34 - Druckfeder
35 - Aushwahlgruppe Distanzscheibe

30 - Dichtblech
393 - Verschlussscharaube
136 - Uberstromventil
104 - Verschlussscharaube
206 - Sechskantmutter

207 - Federring
270 - Kuplungshalfte
135 - Regelventil
471 - Verschlussdeckel
822 - Teilesatz Steuergerat (SA)

50 - Verteilerkorper (SA)
58 - Anschlussstutzen
54 - Dichtscheibe
480 - O Ring
92- Dichtring
807 - Teilesatz Magnetventil DMV 11 (SA)

52 - Aushwahlgruppe Ausgleichscheibe
29 - Hubscheibe
27 - Kreuzscheibe
200 - Druckfeder
103 - Dichtring

21 - Lagerbolzen
22 - Laufrolle
23 - Anlaufscheibe
26 - Haltebugel
25 - Haltebolzen

20 - Rollenring
24 - Verstellbolzen
832 - Teilesatz Antriebswelle
13 - Scheibenfeder
32 - Gleitstuck

31 - Spritzverstellerkolben
17 - Gleitscheibe
9 - Stutzring
7 - Kraftstoff-forderpumpe
3 - Wellendichtring
1- Pumpengehause

50.1 - Verteilerkolben
50.2 - Ausgleichscheibe
50.3 - Federbrucke
50.4 - Druckfeder
50.5 - Federteller
50.6 - Aushwahlgruppe Distanzscheibe
50.7 - Fuhrungsstift
50.8 - Anschlussflansch

## CONNECTORS

T30 - Torx T30
Hex10 - Hexagonal Head #10
Oct17 - Octagonal Head #17
Al #7 - Allen Head #7
Hex22 - Hexagonal Head #22
T25 - Torx T25
T10 - Torx T10
Hex14 - Hexagonal Head #14
CPlug - Cable Plug
SF - Snap Fit
FF - Friction Fit
Rem - Removal Action
T20 - Torx T20
RN - Retaining Nut
Soc - Socket

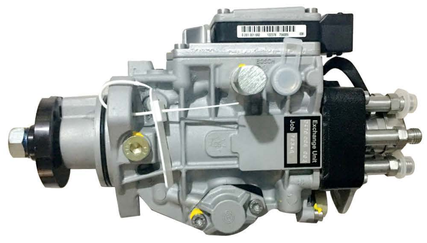
## TOOLS

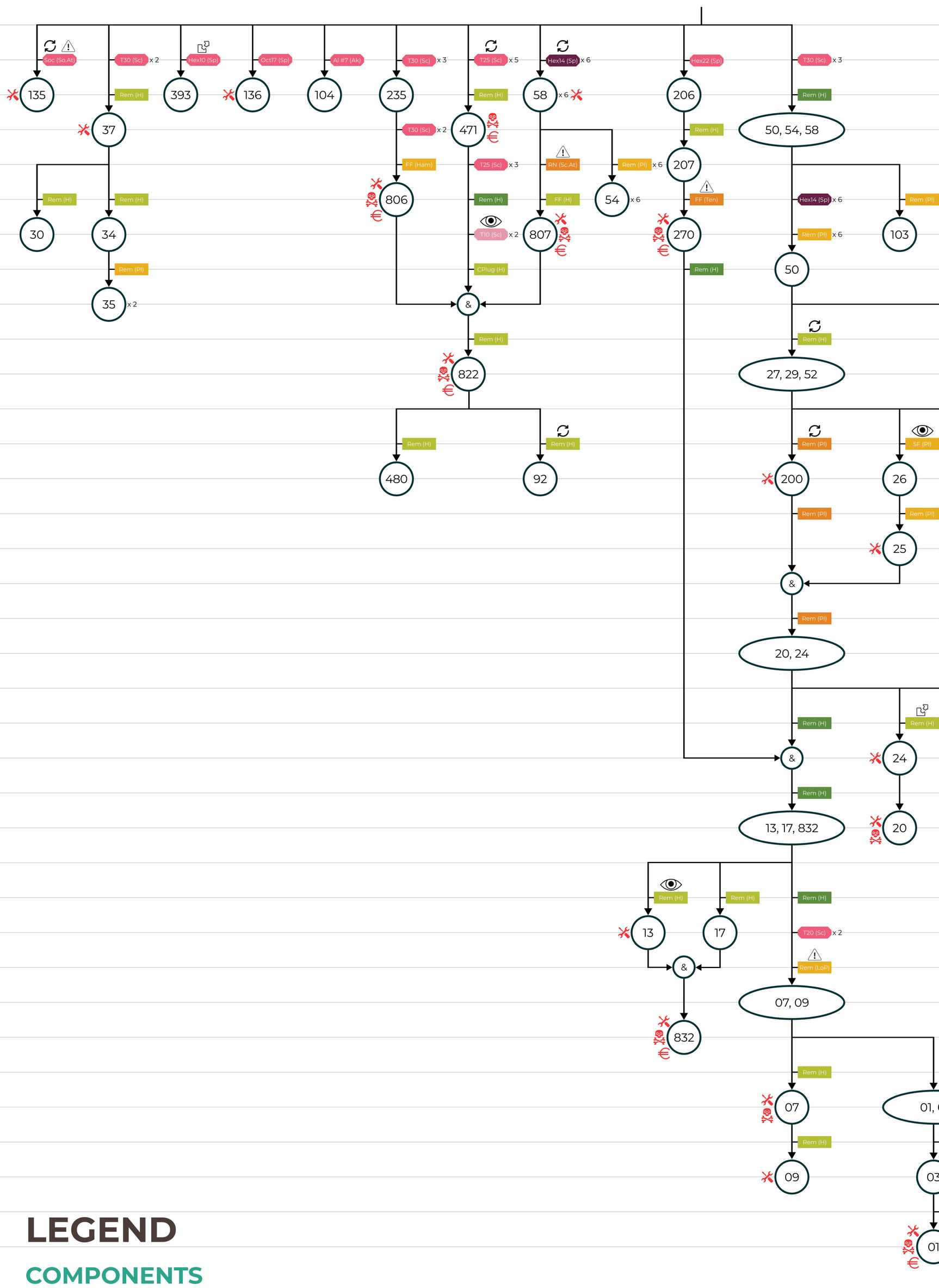
Screwdriver (Sc)
Pliers (Pl)
Hammer (Ham)
Hand (H)
Spanner (Sp)
Allen Key (Ak)
Tensioner (Ten)
Screw Attachment (Sc.At)
Locking Pin (LoP)
Socket Attachment (So.At)

NOTES:
Pos 26 is difficult to disassemble due to small size and difficulty to reach

# BOSCH VP30 DISTRIBUTOR PUMP DISASSEMBLY MAP

A disassembly map showcasing the product architecture, penalty points and priority components






## DISASSEMBLY MAP REFERENCE


de Fazio, F., Bakker, C., Flipsen, B., & Balkenende, R. (2021). The Disassembly Map: A new method to enhance design for product repairability. Journal of Cleaner Production, 320, 128552. https://doi.org/10.1016/j.jclepro.2021.128552


# LEGEND

## COMPONENTS

01- Pumpengehause
03 - Wellendichtring
07 - Kraftstoff-forderpumpe
09 - Stutzring
13 - Scheibenfeder
17 - Gleitscheibe
20 - Rollenring
21 - Lagerbolzen
22 - Laufrolle
23 - Anlaufscheibe
24 - Verstellbolzen
25 - Haltebolzen
26 - Haltebugel
27 - Kreuzscheibe
29 - Hubscheibe
30 - Dichtblech
31 - Spritzverstellerkolben
32 - Gleitstuck
34 - Druckfeder
35 - Aushwahlgruppe Distanzscheibe
37 - Verschlussdeckel
50 - Verteilerkorper (SA)
52 - Aushwahlgruppe Ausgleichscheibe
54 - Dichtscheibe
58 - Anschlussstutzen
92 - Dichtring
103 - Dichtring
104 - Verschlussscharaube
135 - Regelventil
136 - Uberstromventil
200 - Druckfeder
206 - Sechskantmutter
207 - Federring
235 - Stutzplate
270 - Kuplungshalfte
393 - Verschlussscharaube
471 - Verschlussdeckel
480 - O Ring
806 - Teilesatz Magnetventil (SA)
807 - Teilesatz Magnetventil DMV 11 (SA)
822 - Teilesatz Steuergerat (SA)
832 - Teilesatz Antriebswelle

50.1 - Verteilerkolben
50.2 - Ausgleichscheibe
50.3 - Federbrucke
50.4 - Druckfeder
50.5 - Federteller
50.6 - Aushwahlgruppe Distanzscheibe
50.7 - Fuhrungsstift
50.8 - Anschlussflansch

## MOTION INTENSITY




## CONNECTORS

T30 - Torx T30
T25 - Torx T25
T20 - Torx T20
T10 - Torx T10
Hex22 - Hexagonal Head #22
Hex14 - Hexagonal Head #14
Hex10 - Hexagonal Head #10
Oct17 - Octagonal Head #17
Al #7 - Allen Head #7
CPlug - Cable Plug
Soc - Socket
SF - Snap Fit
FF - Friction Fit
RN - Retaining Nut
Rem - Removal Action

## TOOLS

Sc - Screwdriver
Pl - Pliers
Ham - Hammer
H - Hands
Sp - Spanner
Ak - Allen Key
Ten - Tensioner
Sc.At - Screw Attachment
LoP - Locking Pin
So.At - Socket Attachment

## PART INDICATOR

PRIORITY PART

ENVIRONMENTAL IMPACT

ECONOMIC VALUE

## PENALTY POINTS

PRODUCT MANIPULATION

LOW VISIBILITY/ IDENTIFIABILITY

UNCOMMON TOOL

DIFFERENT REASSEMBLY SEQUENCE

KERN

ALT 220-5DAM

15/03/22 Weighing 10:46:51

49.69606 g

0% 100%

Max 60g/220g d=0.01mg/0.1mg
Min 1mg e=1mg

ON OFF | F | UNIT | PRINT SET | TARE →0← ESC

# MAINTENANCE

A → Level 1 - Part wears during use

B, Z → Level 0 - No to low maintenance

---

## FUNCTIONALITY

### At Subassembly Level

- High pressure stage, drive shaft etc. → Level 2 - Main Functionality
- Parts needed for function, not part of main stage → Level 1 - Sub Functionality
- O Rings, washers, shim rings etc. → Level 0 - No to low Functionality

## EXTRA FUNCTIONALITY

### Within Subassembly Level

- Level 2 - Main Functionality → Level 2 - Very important
- Level 2 - Main Functionality → Level 1 - Moderate
- Level 1 - Sub Functionality → Level 1 - Moderate
- Level 1 - Sub Functionality → Level 2 - Not important

| PART NAME | Activity | Priority Part | Environmental | Economic |
|---|---|---|---|---|
| Magnetventil Part | | 🚩 | 🚩 | 🚩 |
| Verschlussdeckel | | 🚩 | | |
| Uberstromventil | | 🚩 | | |
| Kupplungshalfte | 🚩 | 🚩 | 🚩 | 🚩 |
| Verschlussdeckel | | | 🚩 | 🚩 |
| Regelventil | 🚩 | 🚩 | | |
| Steuergerat TS Part | | 🚩 | 🚩 | 🚩 |
| Anschlussstutzen | 🚩 | 🚩 | | |
| Magnetventil DMV 11 TS | 🚩 | | | |
| Magnetventil DMV 11 TS Part | | 🚩 | 🚩 | 🚩 |
| Hubscheibe | | 🚩 | | |
| Kreuzscheibe | 🚩 | 🚩 | | |
| Druckfeder | 🚩 | 🚩 | | |
| Lagerbolzen | | 🚩 | | |
| Laufrolle | | 🚩 | | |
| Anlaufscheibe | | 🚩 | | |
| Haltebugel | 🚩 | | | |
| Haltebolzen | 🚩 | 🚩 | | |
| Rollenring | | 🚩 | 🚩 | |
| Verstellbolzen | | 🚩 | | |
| Teilesatz Antriebswelle | | 🚩 | 🚩 | 🚩 |
| Scheibenfeder | | 🚩 | | |
| Gleitstuck | | 🚩 | | |
| Spritzverstellerkolben | | 🚩 | | 🚩 |
| Stutzring | | 🚩 | | |
| Stutzring | 🚩 | | | |
| Kraftstoff-forderpumpe | 🚩 | 🚩 | 🚩 | |
| Pumpengehause | | 🚩 | 🚩 | 🚩 |
| Verteilerkolben | | 🚩 | | 🚩 |
| Federbrucke | | 🚩 | | |
| Druckfeder | | 🚩 | | |
| Federteller | | 🚩 | | |
| Fuhrungsstift | | 🚩 | | |
| Anschlussflansch | | 🚩 | 🚩 | 🚩 |

| Technology | Maturity | Cost ($) | Facility Requirements | Part Size | Precision |
|---|---|---|---|---|---|
| **Powder Bed Fusion** | High ●●● | 500k - 1M+ $$$ | Powder management, ventilation, post-processing equipment (CNC, EDM, HIP, heat treatment) | 2mm - 350mm  | High ●●● |
| **Binder Jetting** | Low ●○○ | 300k - 2M+ $$$ | Powder management, batch sintering solution, post-processing equipment (surface finishing, heat treatment) | 1mm - 150mm  | High ●●● |
| **Bound Powder Extrusion*** | Medium ●●○ | 150 - 200k $$$ | Basic ventilation (not for metal powder), post-processing depending on use case (CNC, heat treatment, surface finishing) | 10mm - 250mm  | Medium ●●○ |



SCORE = 0



SCORE = 1



SCORE = 2

| | | | |
|---|---|---|---|
| GEOMTERY | • Lots of precision features<br>• Lots of internal features<br>• Has a high aspect ratio<br>• Needs support structures | • Few complex surfaces<br>• Few curves and drafts<br>• Some precision features<br>• Has a medium aspect ratio<br>• Might need support structures | • No precision inserts<br>• Low aspect ratio<br>• Few holes<br>• Very few internal features<br>• Few unsupported features |
| 3D MODELLING DIFFICULTY | • Complex model<br>• Internal features<br>• Precision features<br>• External curved surfaces<br>• Internal curved surfaces<br>• Might need 3D scanning | • Slightly complex model<br>• Internal features<br>• External curved surfaces<br>• Some precision features | • Simple model<br>• Basic features such as bosses, sweeps, rotations, and cuts |
| VALUE | • Solid or dense infill<br>• Thick walls | • Low functionality<br>• Low wear parts<br>• Medium thickness walls | • High functionality<br>• Wear parts<br>• Hollow/thin-walled parts |

| PART NAME | Priority Part | Environment | Economic | Material Availability | Geometry | 3D Model | Value | Score | **Selection** |
|---|---|---|---|---|---|---|---|---|---|
| Verschlussdeckel | 🟡 | | | 🟢 | 🟢 | 🟢 | 🟢 | 8 | 🟢 |
| Kupplungshälfte | 🔴 | 🟡 | 🟡 | 🟢 | 🟡 | 🟢 | 🔴 | 0 | 🔴 |
| Verschlussdeckel | | 🟡 | 🟡 | 🟢 | 🟢 | 🟢 | 🟡 | 4 | 🟡 |
| Anschlussstutzen | 🔴 | | | 🟢 | 🔴 | 🟡 | 🟡 | 0 | 🔴 |
| Hubscheibe | 🔴 | | | 🟢 | 🟢 | 🟡 | 🟢 | 4 | 🟢 |
| Rollenring | 🔴 | 🟡 | | 🟢 | 🟡 | 🟢 | 🟡 | 2 | 🟡 |
| Teilesatz Antriebswelle | 🔴 | 🔴 | 🔴 | 🟢 | 🔴 | 🟢 | 🔴 | 0 | 🔴 |
| Spritzverstellerkolben | 🔴 | | 🟡 | 🟢 | 🟡 | 🟢 | 🟢 | 4 | 🟡 |
| Kraftstoff Förderpumpe | 🔴 | 🟡 | | 🟢 | 🟡 | 🟢 | 🟡 | 2 | 🟡 |
| Pumpengehäuse | 🔴 | 🔴 | 🔴 | 🟢 | 🔴 | 🔴 | 🟢 | 0 | 🔴 |
| Verteilerkolben | 🔴 | | 🟡 | 🟢 | 🟡 | 🟢 | 🟡 | 2 | 🟢 |
| Anschlussflansch | 🔴 | 🔴 | 🟡 | 🟢 | 🔴 | 🟡 | 🔴 | 0 | 🔴 |

















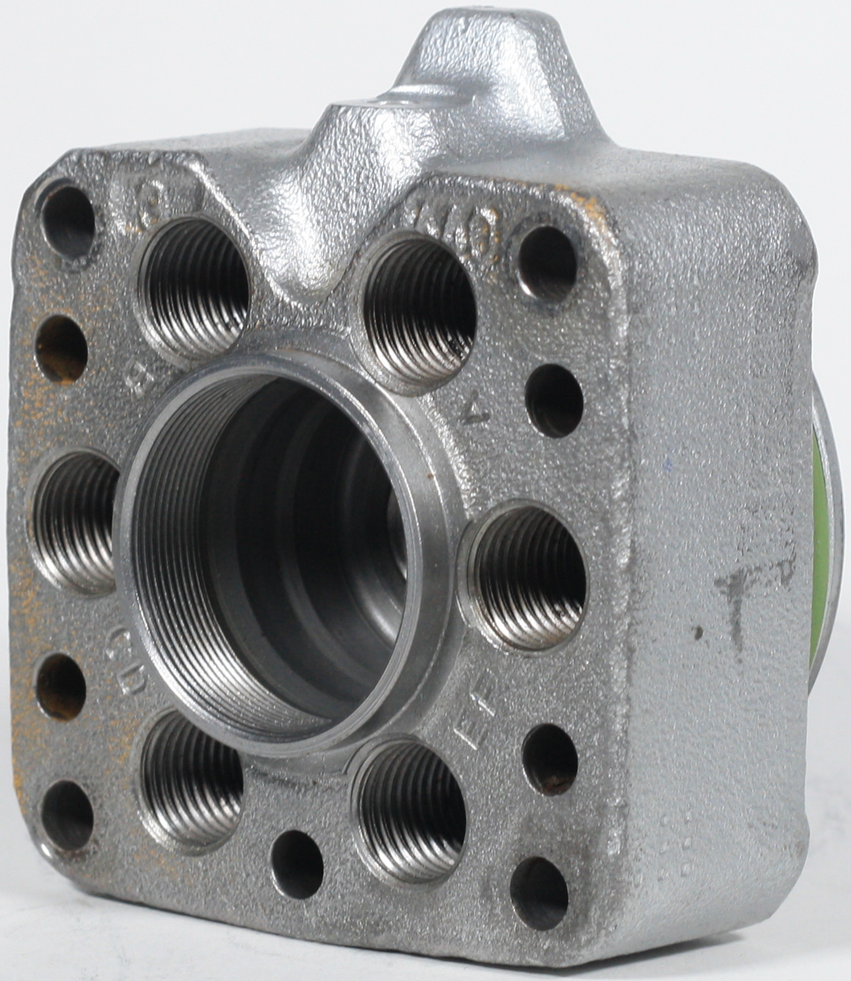
Perkins

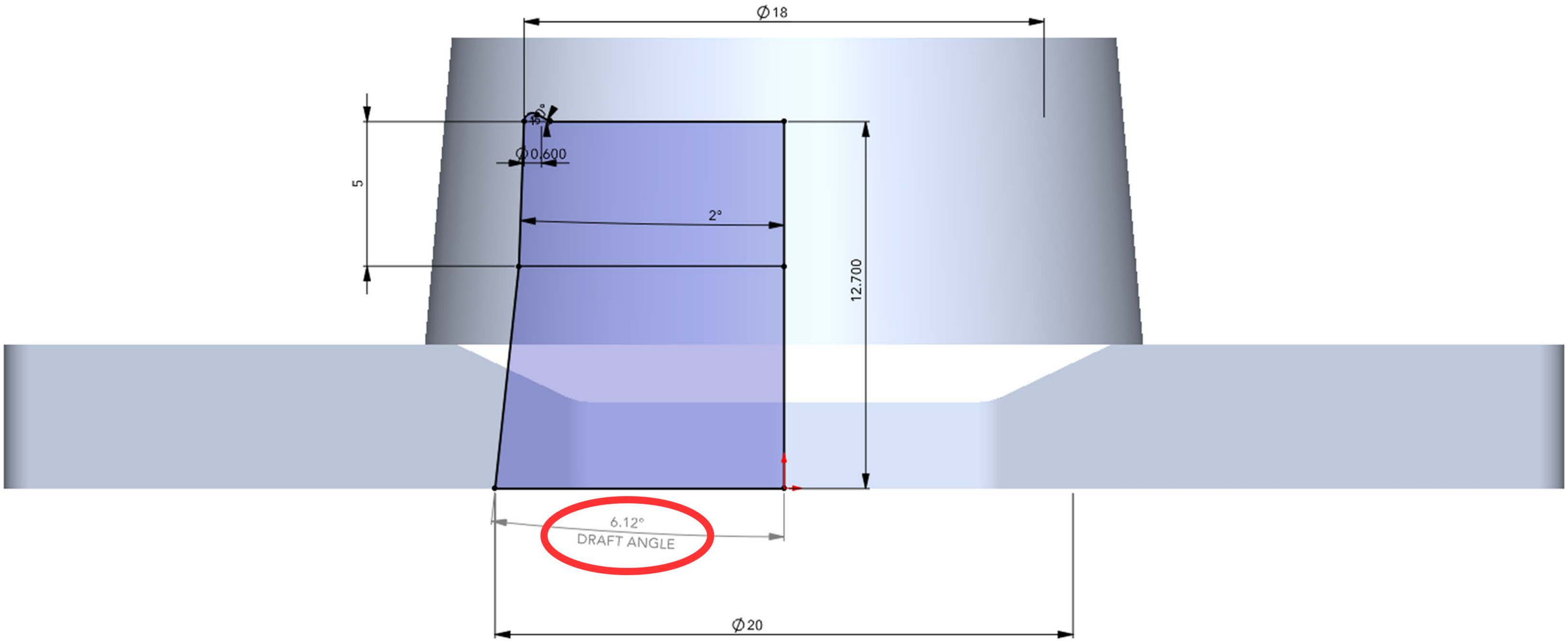
2644P501 24V

583449331

BOSCH






Ø18
45°
Ø0.600
5
2°
12.700
6.12°
DRAFT ANGLE
Ø20

Ø20.050
GUIDE CURVE DIAMETER

Ø20.050
GUIDE CURVE DIAMETER

7

6.500

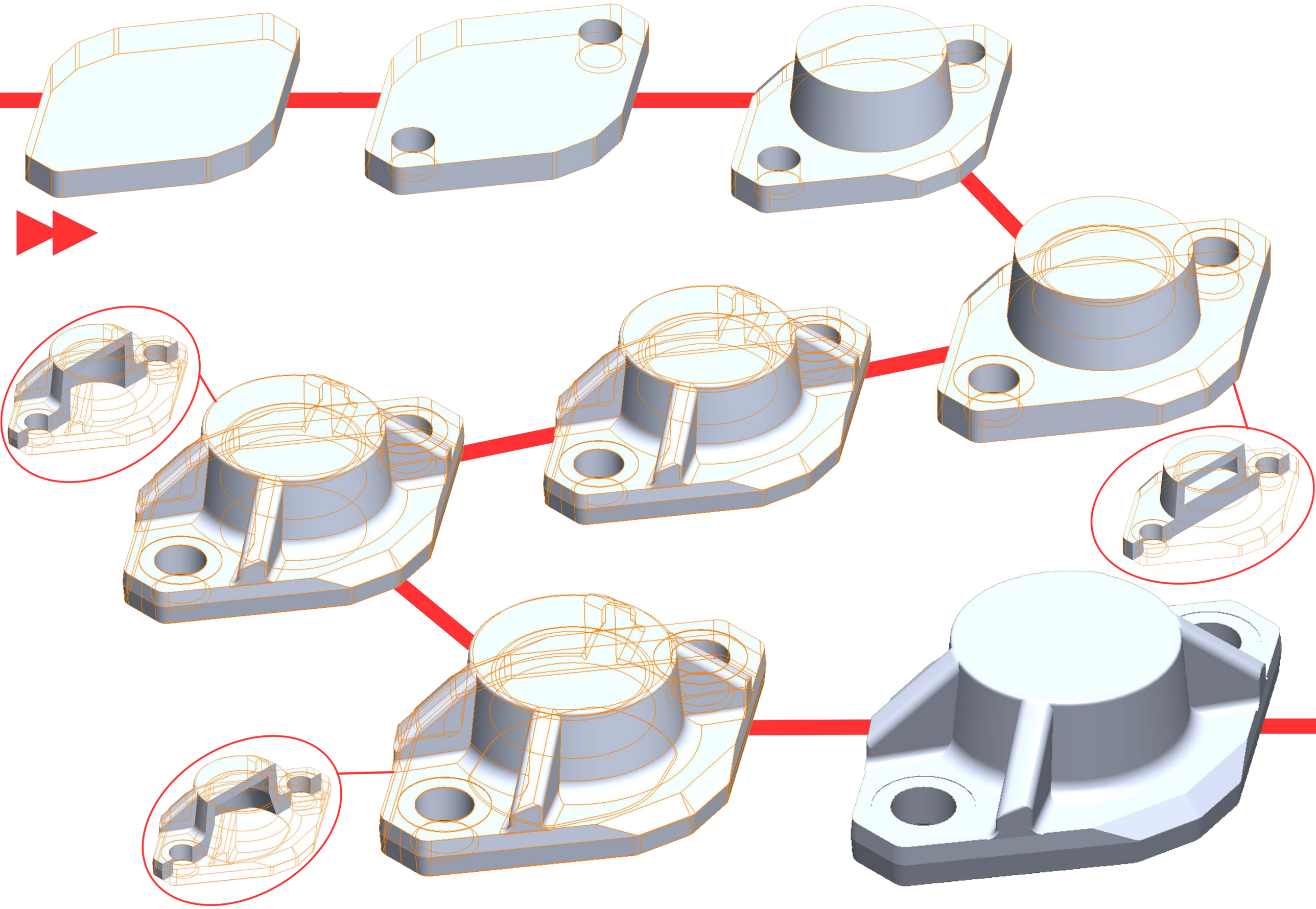
R2

6.500

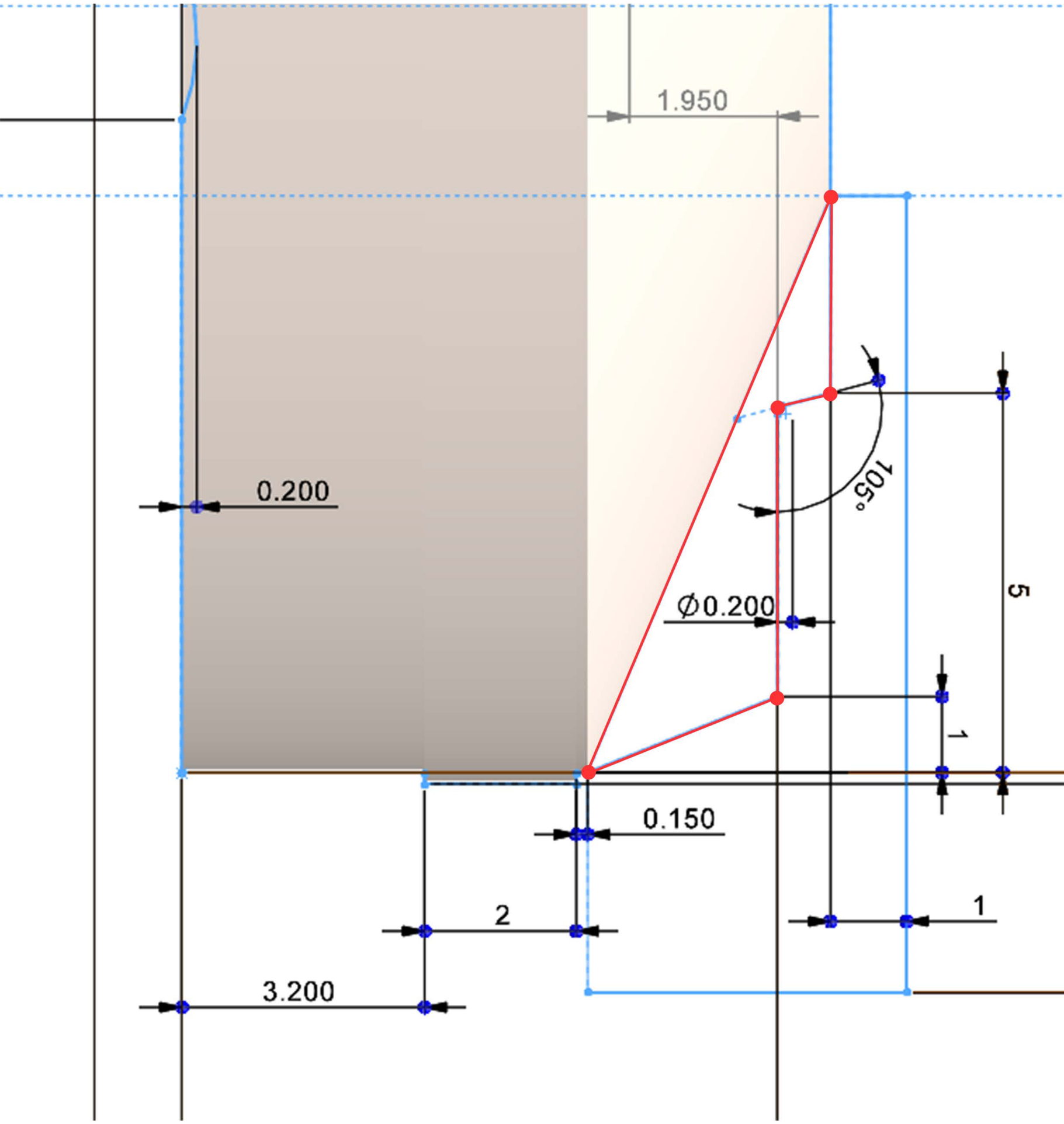
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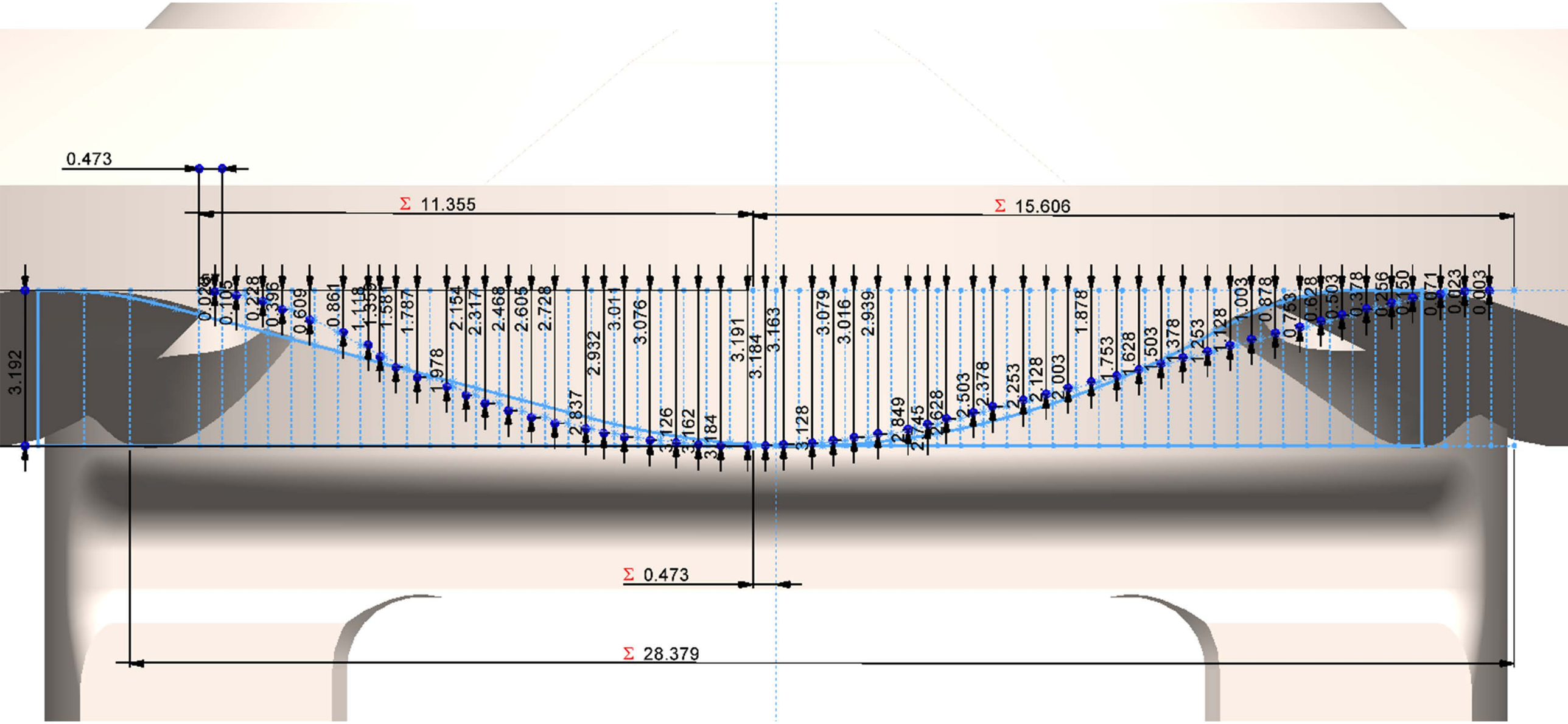
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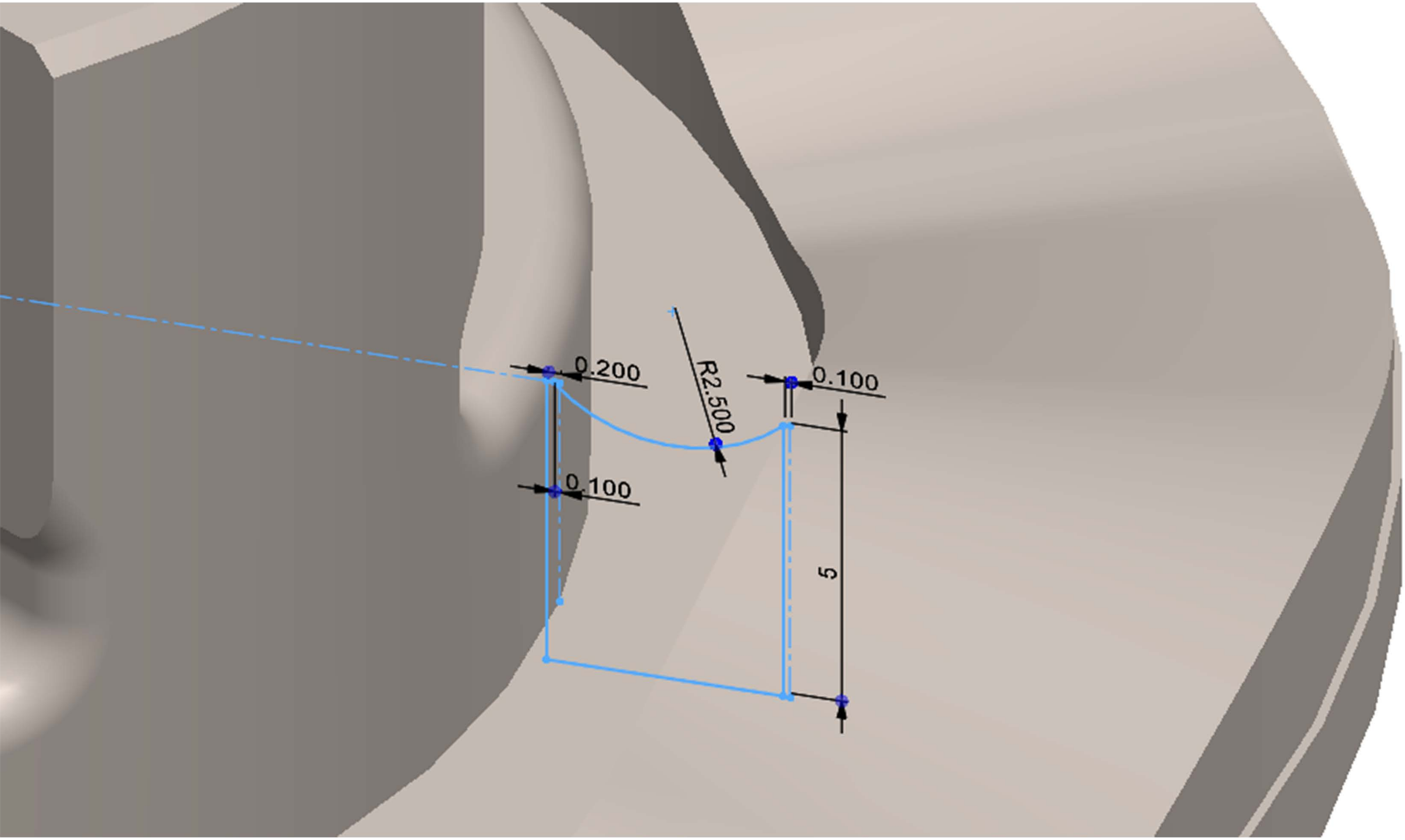
+0.300
Ø23.500 0

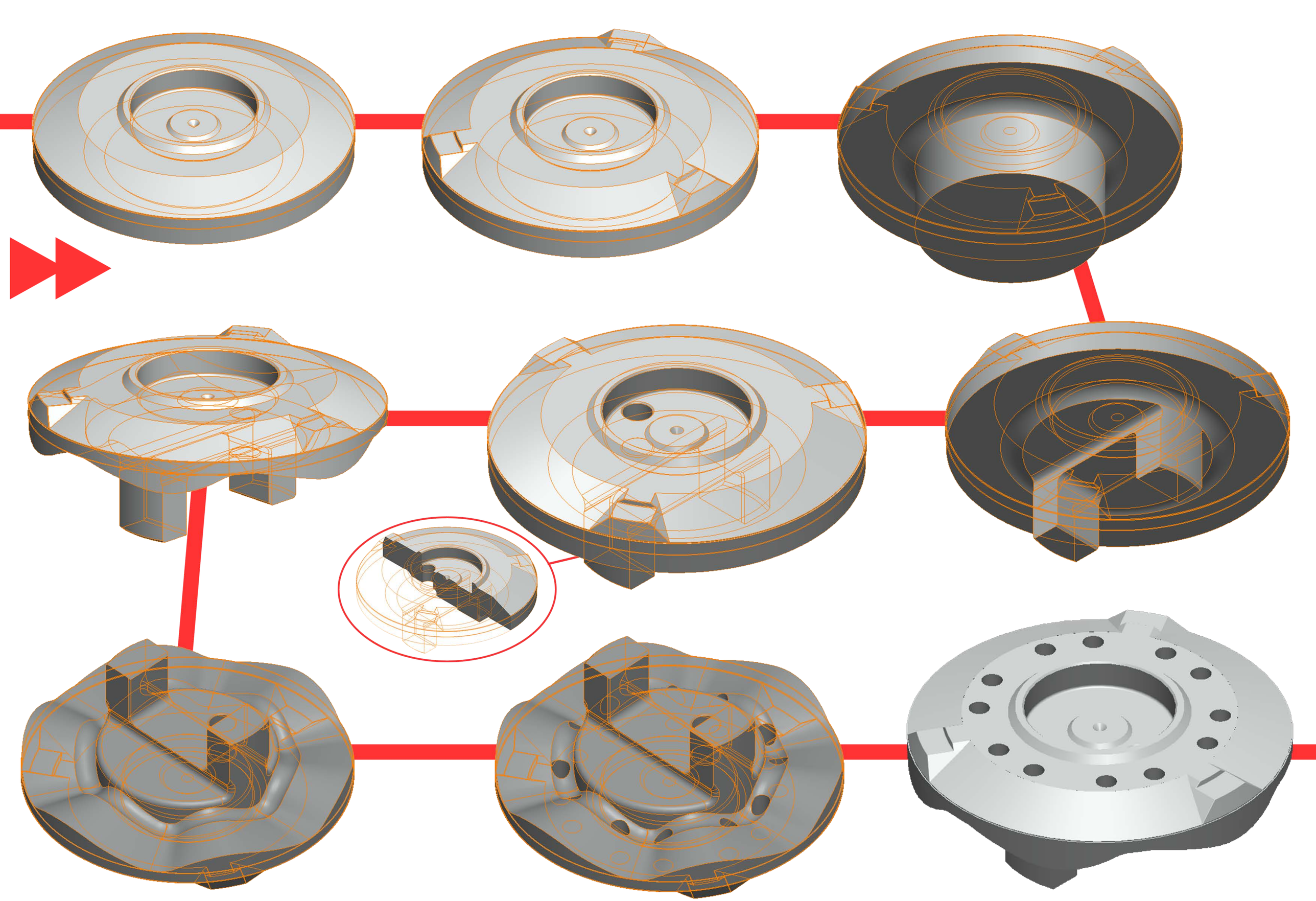


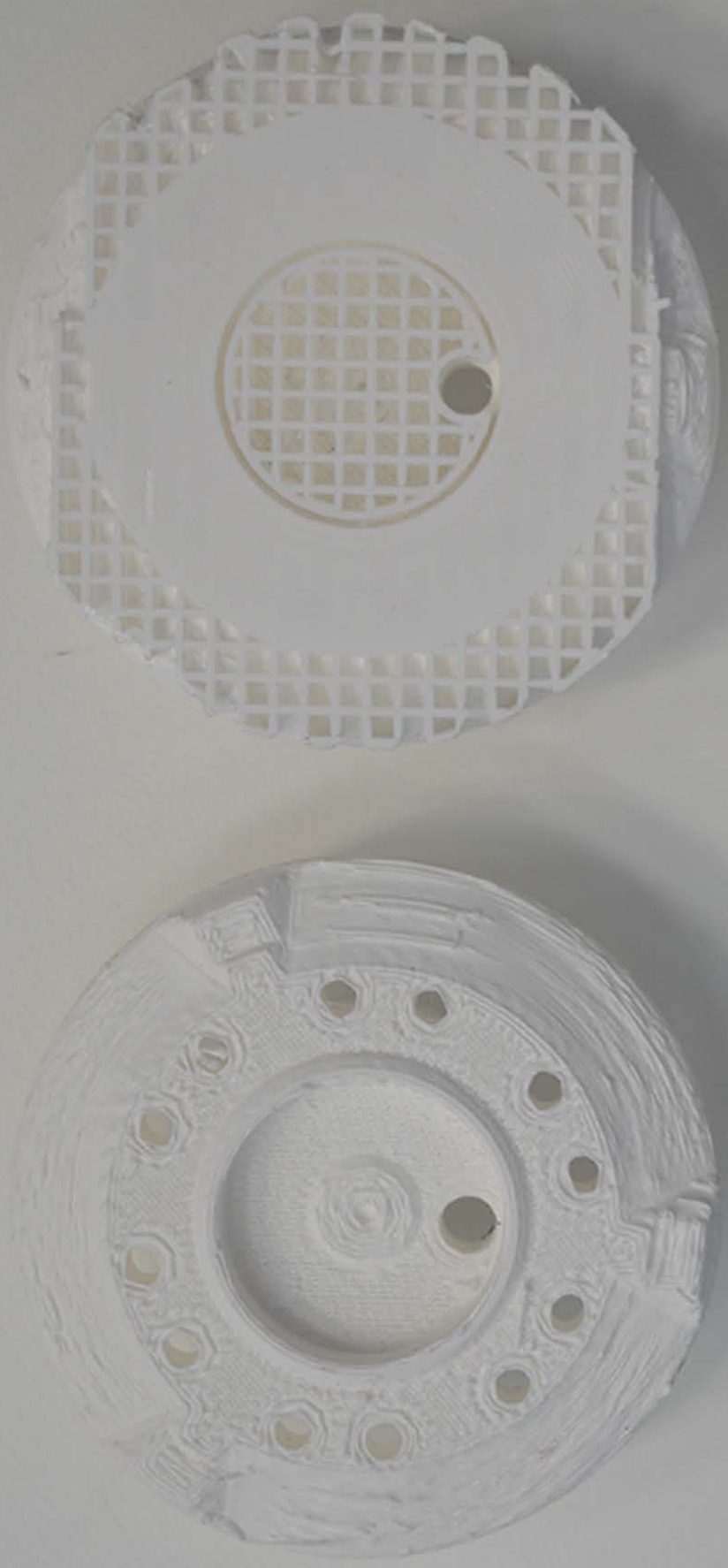


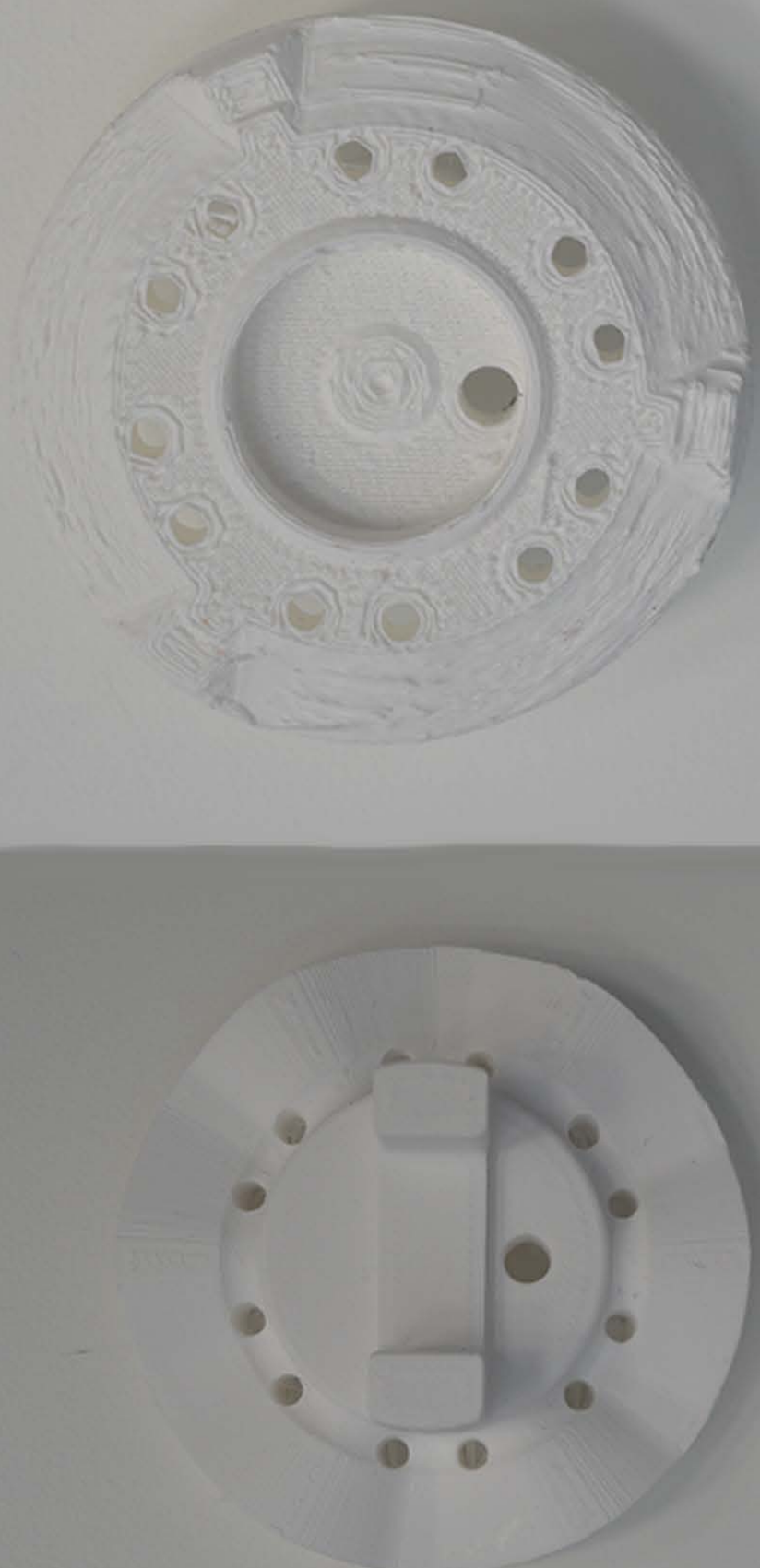

1.950
0.200
105°
Ø0.200
5
1
0.150
2
1
3.200


0.473
Σ 11.355
Σ 15.606
3.192
0.025
0.105
0.228
0.396
0.609
0.861
1.118
1.359
1.581
1.787
1.978
2.154
2.317
2.468
2.605
2.728
2.837
2.932
3.011
3.076
3.126
3.162
3.184
3.191
3.184
3.163
3.128
3.079
3.016
2.939
2.849
2.745
2.628
2.503
2.378
2.253
2.128
2.003
1.878
1.753
1.628
1.503
1.378
1.253
1.128
1.003
0.878
0.753
0.628
0.503
0.378
0.256
0.150
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0.023
0.003
Σ 0.473
Σ 28.379


0.200
R2.500
0.100
0.100
5



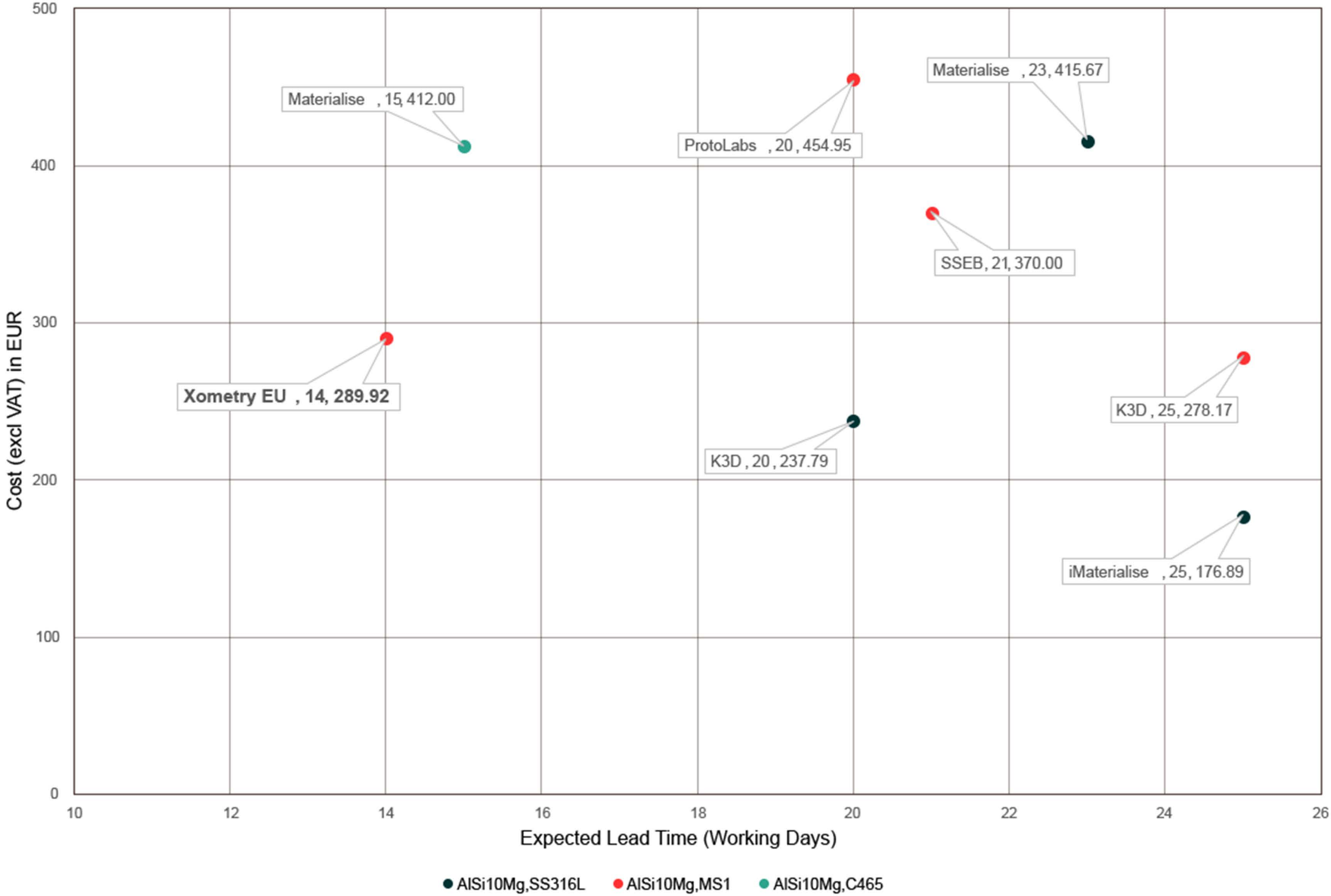









# 3D Printing Quotations












8595

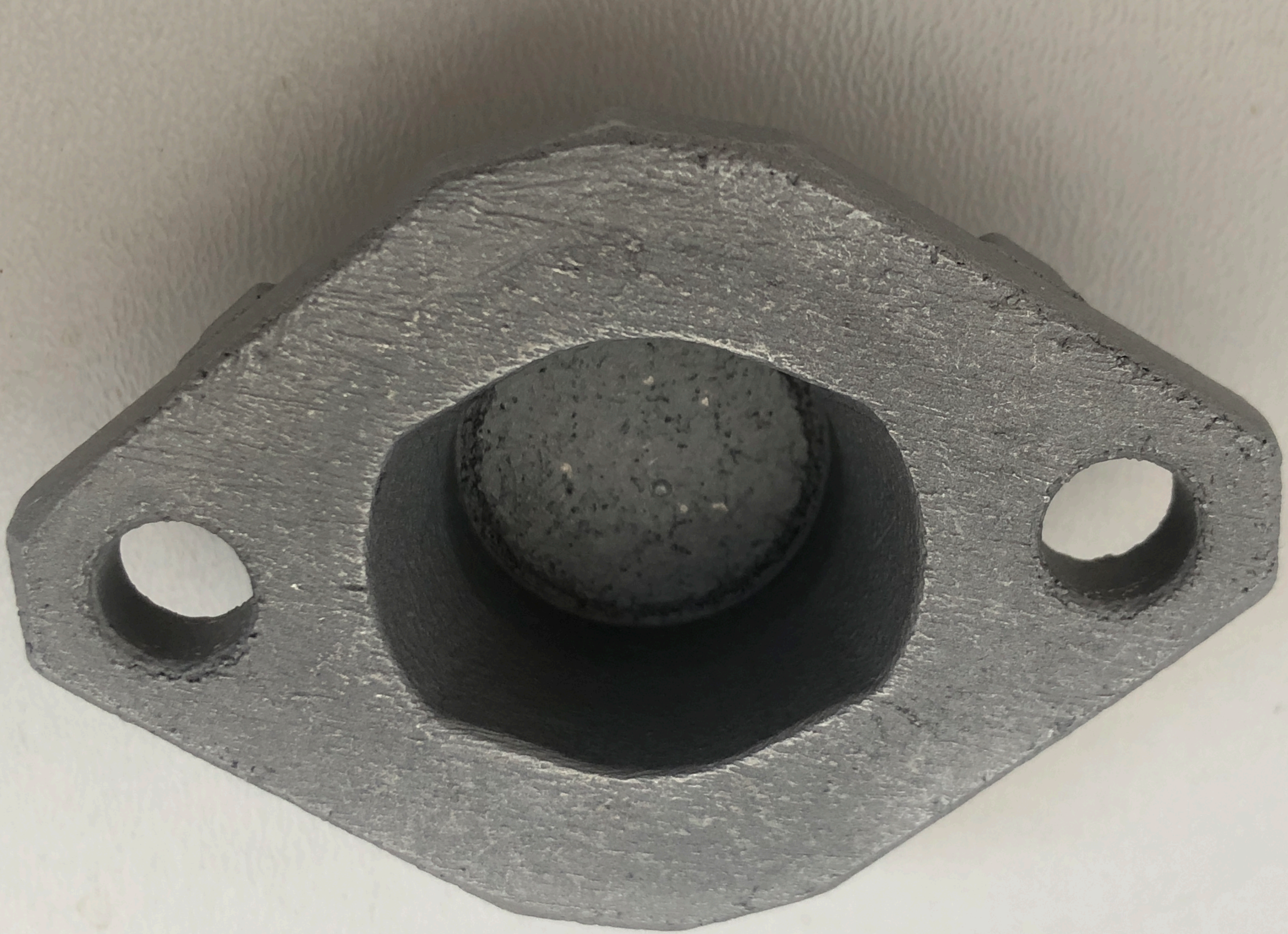


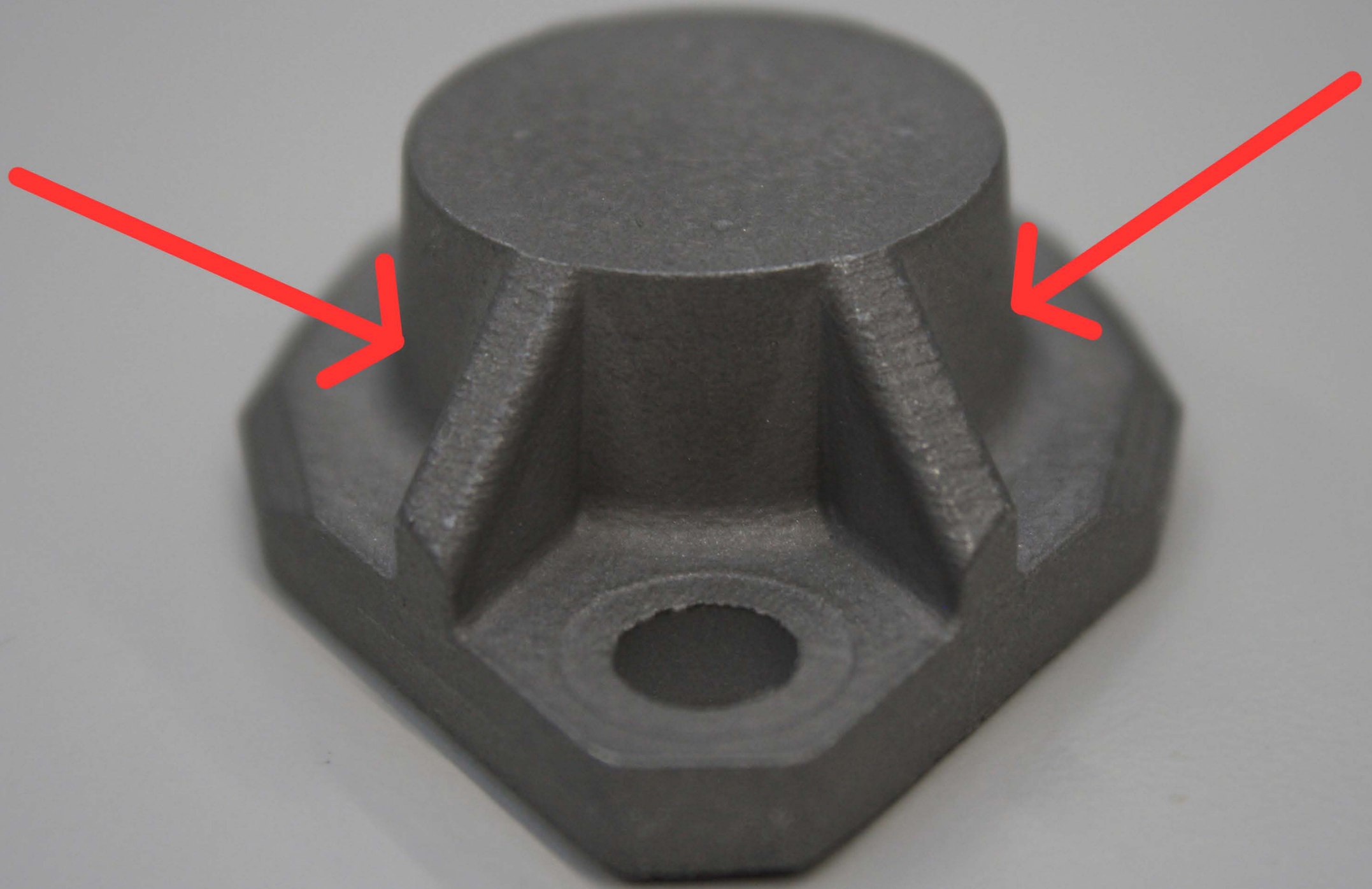


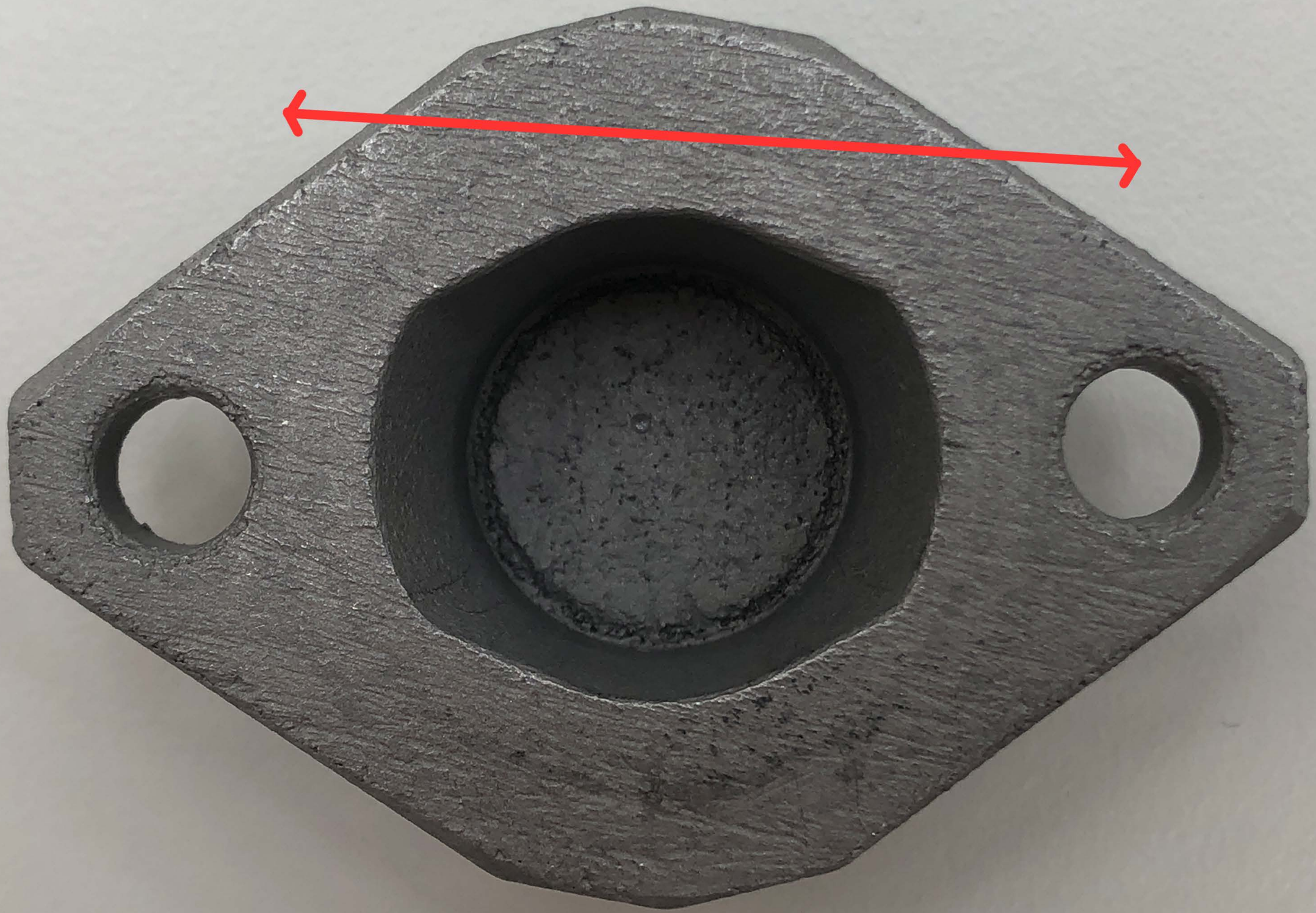


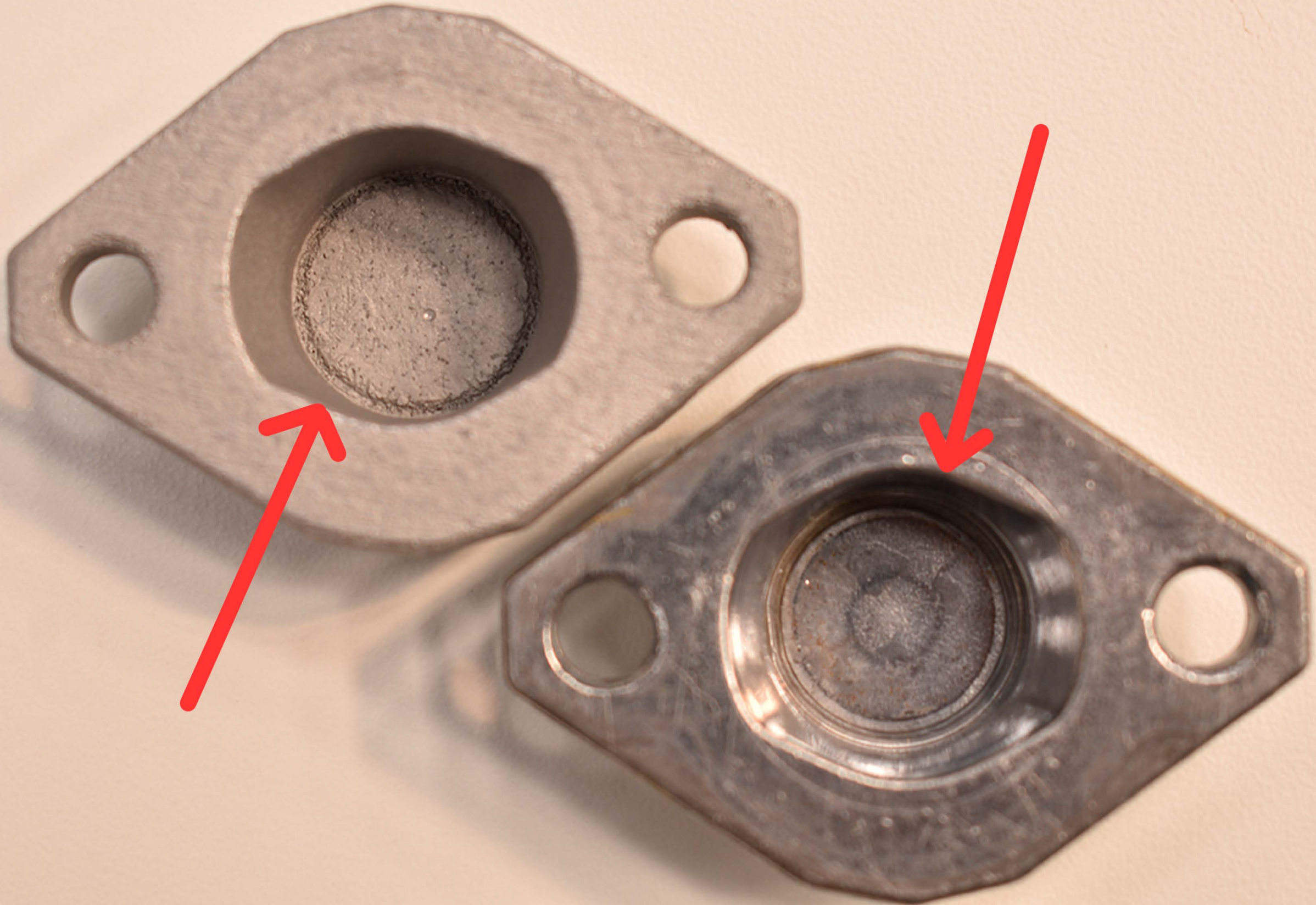

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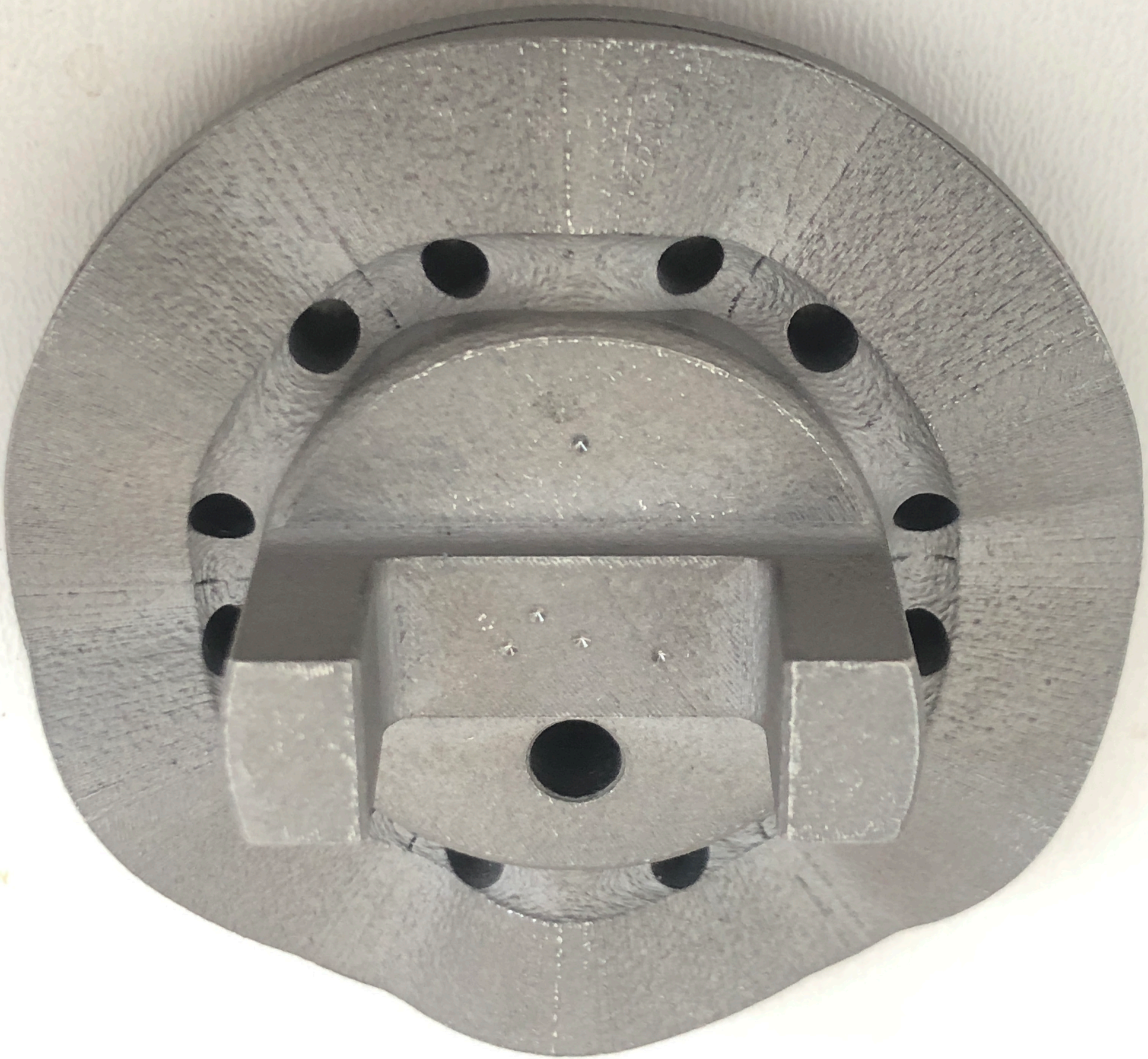


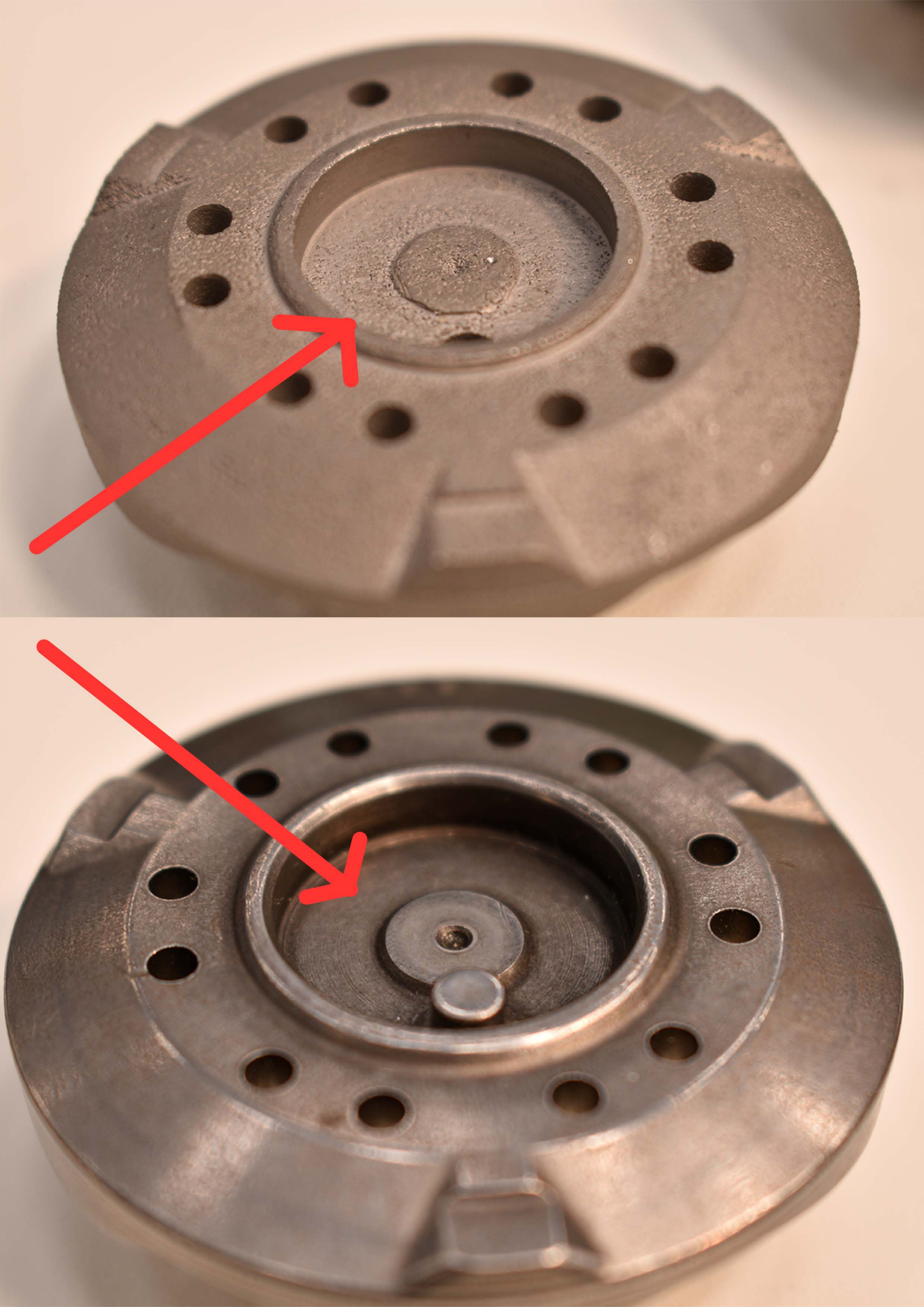


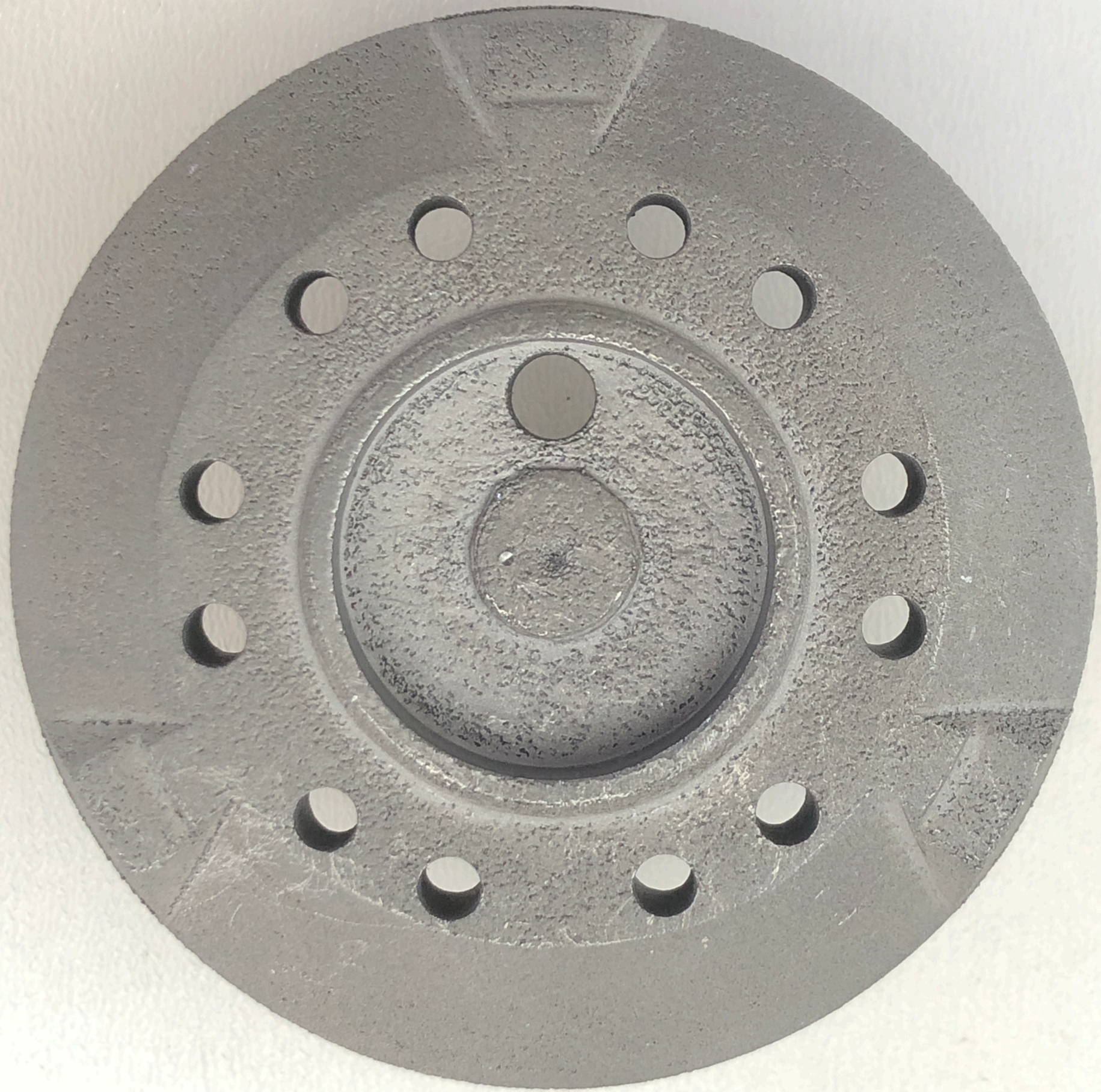


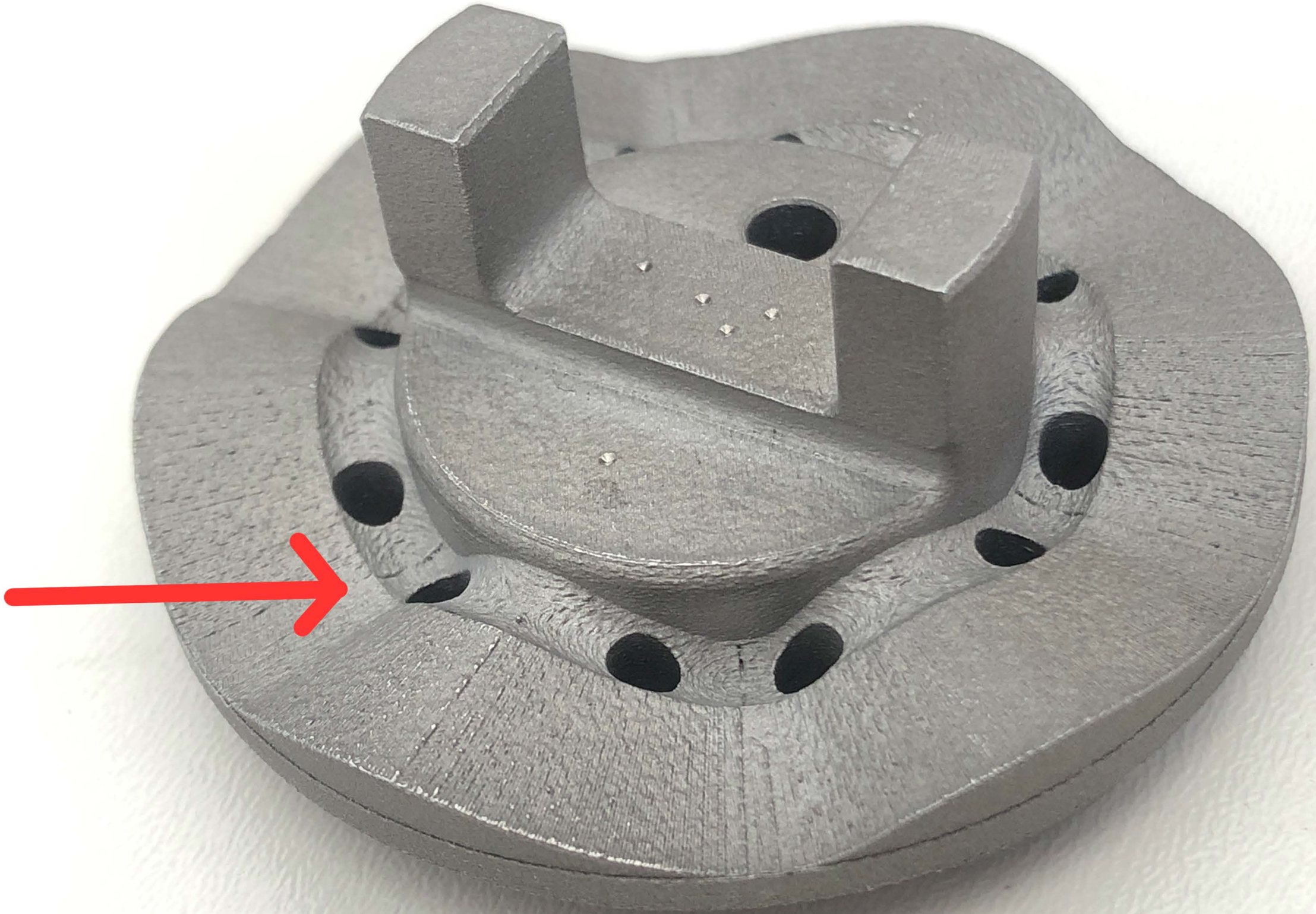


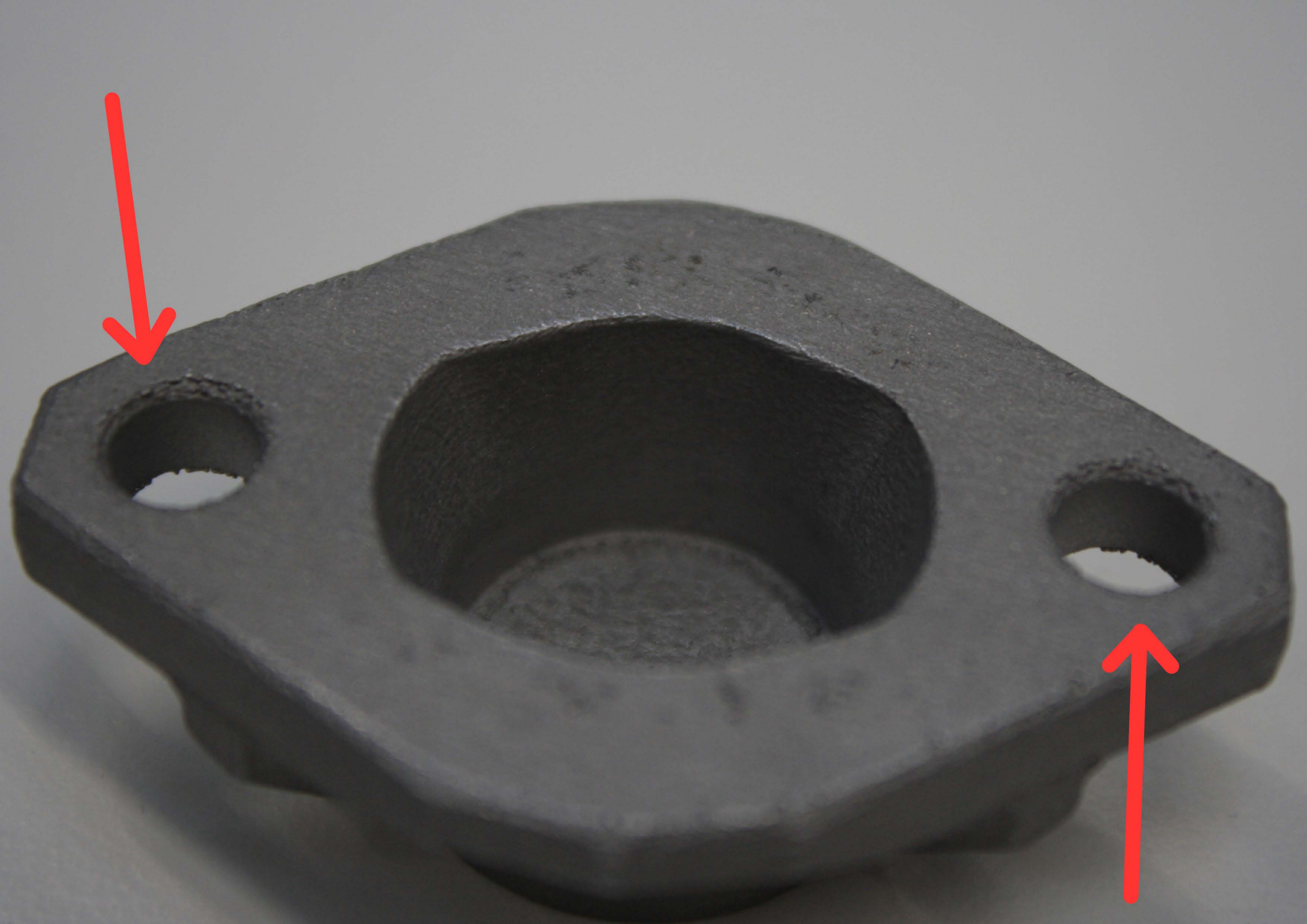


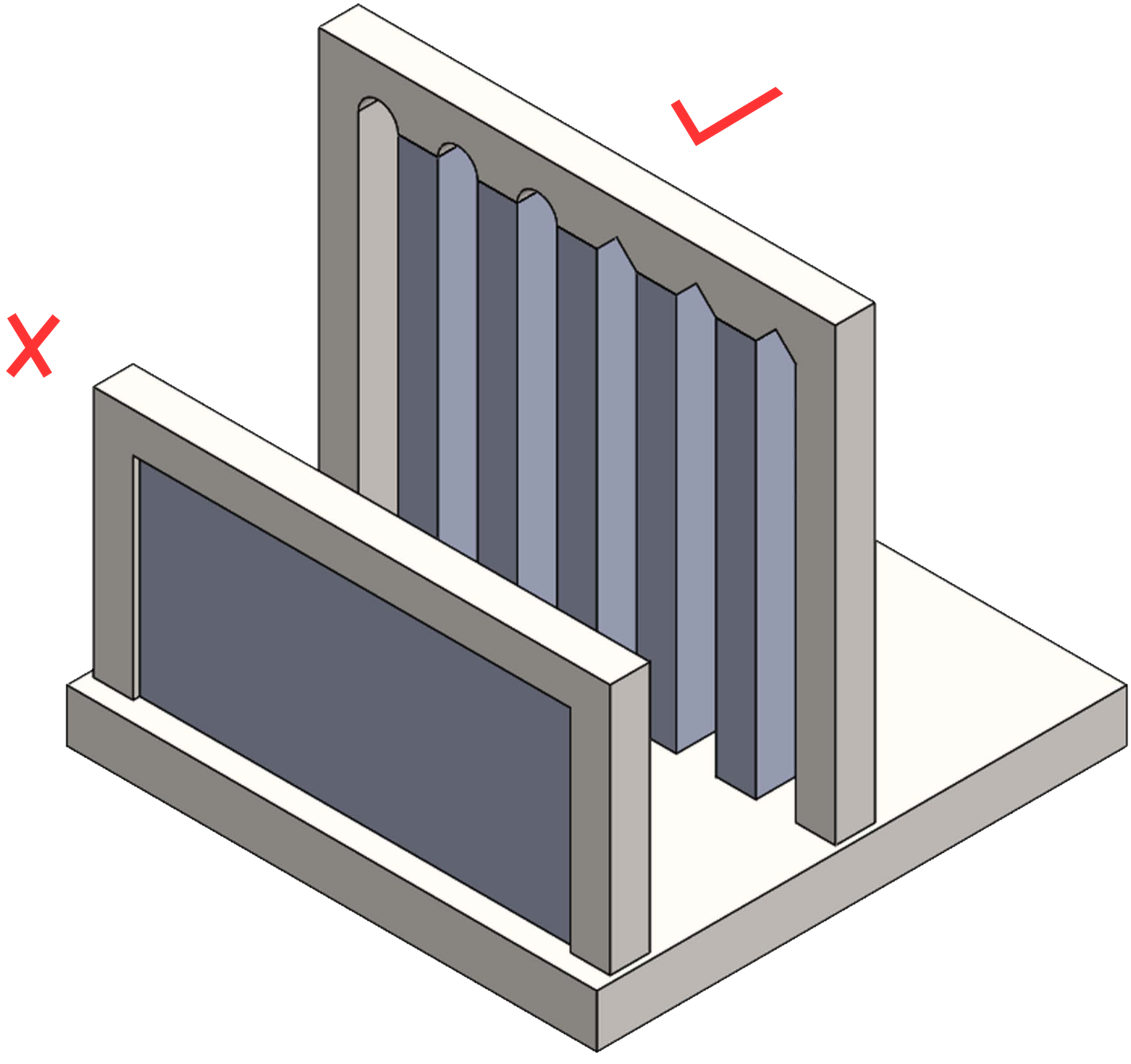




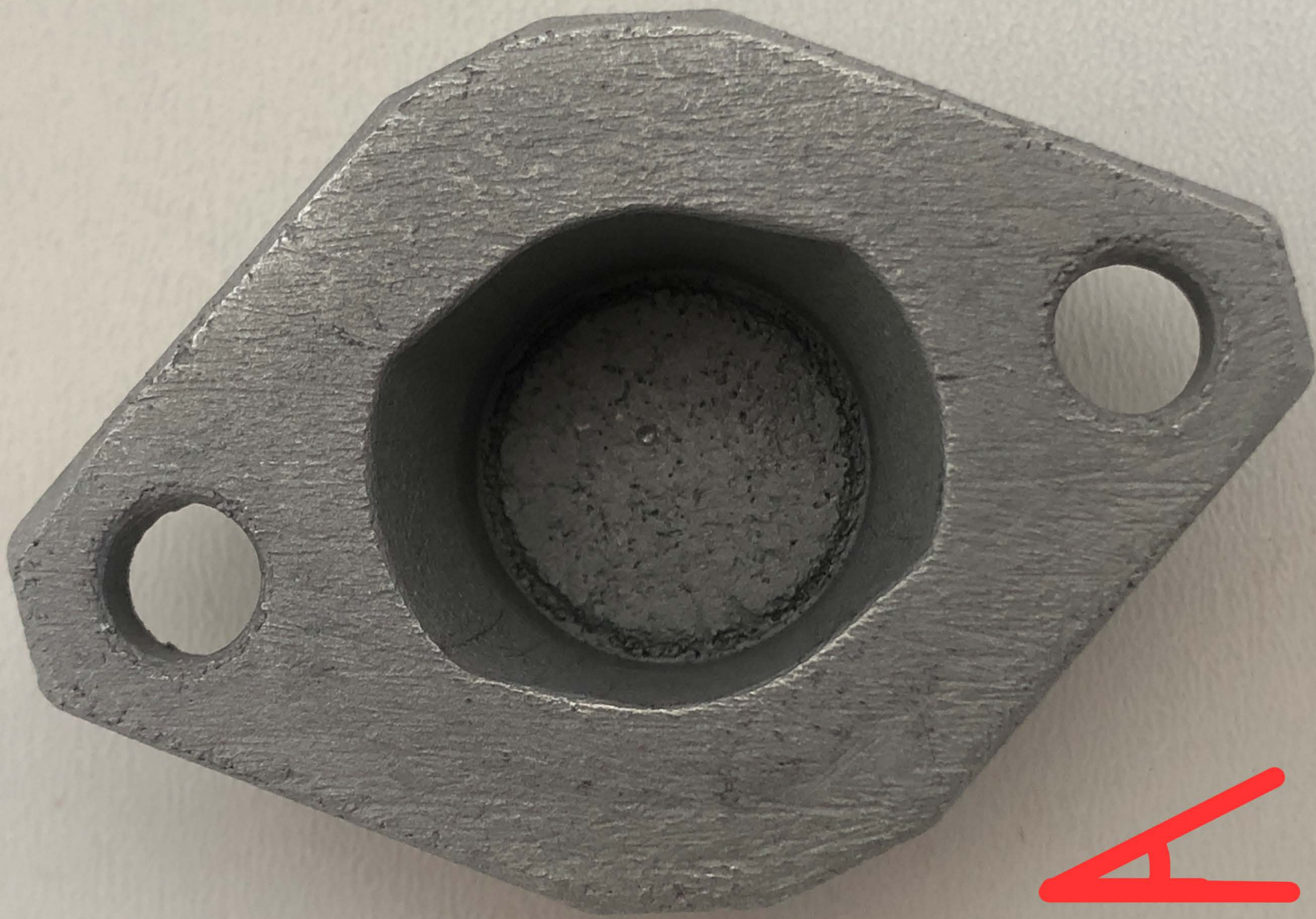








PRINT ORIENTATION



gorenje
Life Simplified



**Lifecycle profile**

The Asko washing machine will have three use cycles of five years, resulting in a total lifecycle of 15 years and perform a total of 15000 washes. This lifecycle setup assumes the product is used under the following conditions: <needs specifications>.

**End-of-Life Scenario's**

- Direct reuse
- Recycle
- Remanufacture
- Upgrade
- Incinerate
- Spare sub-assembly
- Replace

**Obsolescence type**

- Technological obsolescence
- Functional obsolescence
- Emotional obsolescence

**Sub-assembly labels**

- High impact sub-assembly
- Key failure sub-assembly

**Product use-cycle origin:**

- First use-cycle
- Second use-cycle
- Third use-cycle

| Sub-assembly picture | Sub-assembly name | Sub-assembly categories | Obsolescence type | Production | Forward logistics | Storage | Forward logistics | Use | Reverse logistics | Recovery | Forward logistics | Use | Reverse logistics | Recovery | Forward logistics | Use | Reverse logistics | Recovery |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | 0 months | | | 40 months | | | | 41 months | | | 120 months | | | | |
| | Motor | KF | | | | | | ! | | → | | ! | | ⇄ 🔥 | | ! | | ◎ |
| | Transmission | | | | | | | | | → | | | | → | | | | ◎ |
| | Support | | | | | | | | | → | | | | → | | | | ◎ |
| | Drum | | | | | | | | | → | | | | → | | | | ◎ |
| | Control unit | KF | | | | | | | | ⇄ 🔥 | | | | ⇄ 🔥 | | | | ◎ |
| | Door | | | | | | | | | → | | | | → | | | | ◎ |
| | Inlet | | | | | | | | | → | | | | → | | | | ◎ |
| | Temperature Regulator | | | | | | | | | → | | | | → | | | | ◎ |
| | Front, side, top panel | | | | | | | | | → | | | | → | | | | ◎ |
| | Rear panel | | | | | | | | | → | | | | → | | | | ◎ |
| | Holder | | | | | | | | | → | | | | → | | | | ◎ |
| | Drain | KF | | | | | | | | → | | | | → | | | | ◎ |
| Line of activity | | | | | | | | | | | | | | | | | | |
| | Bottlenecks | | | | | | | Example space of bottleneck explanation | | | | Example space of bottleneck explanation | | | | Example space of bottleneck explanation | | |
| gorenje | Gorenje | | | Manufacture/ order sub-assembles<br>Assemble product | Transport product from Gorenje to ATAG | | | | | Send/supply spare sub-assembles | | | | Send/supply spare sub-assembles | | | | Buy back reusable parts |
| ATAG | Atag | | | | Order product from Gorenje | Store product at ATAG before transport<br>Create quotation for homie | Transport product from Atag to Homie | | | Ipreiorder spare parts<br>Have product inspected on state/quality<br>Replace Control unit if necessary | Transport product from Atag to Homie | | | Ipreiorder spare parts<br>Have product inspected on state/quality<br>Replace Motor & Control unit if necessary | Transport product from Atag to Homie | | Transport product from ATAG to recycler | |
| homie | Homie | | | | Order product from Atag | Transport product from Homie to customer | Install product at customer location<br>Notify ATAG of product defects | Uninstall product at customer location<br>Transport product from customer to ATAG | | Transport product from Homie to customer | Install product at customer location<br>Notify ATAG of product defects | Uninstall product at customer location<br>Transport product from customer to ATAG | | Transport Product from ATAG to customer | Install product at customer location<br>Notify ATAG of product defects | Uninstall product at customer location<br>Transport product from customer to ATAG | |
| | Third party Recycler | | | | | | | | | | | | | | | | | Disassemble product for reusable parts |

gorenje
Life Simplified



Lifecycle profile

The VP30 pump installed on a new passenger car running on paved concrete roads for 200,000 km on Diesel 1 fuel in the city of Munich, Germany during all months of the year.

*Set specific scenario for this use case of the VP30 pump*

End-of-Life Scenario's

*EoL scenarios are already set per part and thus can be customised as per product being assessed*

- *Replace with old washed parts*
- ~~Recycle~~
- ~~Remanufacture~~
- ~~Upgrade~~
- *Scrap*
- ~~Repair~~
- *For VP30 pump*
- *Replace with new parts*
- ~~Undefined~~
- ~~Spare sub-assembly~~

Obsolescence type

- Technological obsolescence
- Functional obsolescence
- Emotional obsolescence

Sub-assembly labels

- High impact sub-assembly
- Key failure sub-assembly

Product use-cycle origin:

- First use-cycle
- Second use-cycle
- Third use-cycle

*Together with year based data, this gives a better insight into the product lifecycle.*

*Change to priority parts based Hotspot Map results instead of subassembly*

*All parts will have some category since they are priority parts*

*Only 'functional' since other types do not apply for the pump*

0 year | 1 year | 2 year | 3 year | 4 year | 5 year | 6 year | 7 year | 8 year | 9 year

*Every part does not have the same life so colors can be changed to showcase the year it belongs to with a legend for diff activities (example shown)*

| Sub-assembly picture | Sub-assembly name | Sub-assembly categories | Obsolescence type | Production | Forward logistics | Storage | Forward logistics | Use | Reverse logistics | Recovery | Forward logistics | Use | Reverse logistics | Recovery | Forward logistics | Use | Reverse logistics | Recovery |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
|  | Motor | KF | | | | | | | | | | | and so on..... | | | | | |
|  | Transmission | | | | | | | | | | | | | | | | | |
|  | Support | | | | | | | | | | | | | | | | | |
|  | Drum | | | | | | | | | | | | | | | | | |
|  | Control unit | 1 KF | | | | | | | | | | | 1 and so on..... | | | | | |
| | | 2 KF | | | | | | | | | | | 2 | | | | | |
|  | Inlet | | | | | | | | | | | | | | | | | |
|  | Temperature Regulator | | | | | | | | | | | | | | | | | |
|  | Front, side, top panel | | | | | | | | | | | | | | | | | |
|  | Rear panel | | | | | | | | | | | | | | | | | |
|  | Holder | | | | | | | | | | | | | | | | | |
|  | Drain | KF | | | | | | | | | | | | | | | | |
| Line of Activity | | | | | | | | | | | | | | | | | | |
| gorenje | Gorenje | | | Manufucture/ order sub-assemblies; Assemble product | Transport product from Gorenje to ATAG | | | | | Send/supply spare sub-assemblies | | | | Send/supply spare sub-assemblies | | | | Buy back reusable parts |
| ATAG | Atag | | | | Order product from Gorenje | Store product at ATAG before transport; Create quotation for Homie | Transport product from Atag to Homie | | | (pre)order spare parts; Have product inspected on state/quality; Replace Control unit if necessary ! | Transport product from Atag to Homie | | | (pre)order spare parts; Have product inspected on state/quality; Replace Control unit if necessary !; Replace Motor if necessary ! | Transport product from Atag to Homie | | Transport Product from ATAG to recycler | |
| homie | Homie | | | | | Order product from Atag | Transport product from Homie to customer | Install product at customer location; Notify ATAG of product defects | Uninstall product at customer location; Transport product from customer to ATAG | | Transport product from Homie to customer | Install product at customer location; Notify ATAG of product defects | Uninstall product at customer location; Transport product from customer to ATAG | | Transport Product from ATAG to customer | Install product at customer location; Notify ATAG of product defects | Uninstall product at customer location; Transport product from customer to ATAG | |
| | Third party Recycler | | | | | | | | | | | | | | | | | Dissassemble product for reusable parts |

*This line showcases a scenario when it becomes clear at what point of the life cycle various activities take place. The production and forward logistics take place in the 1st year and then it is stored for 1 year. In the second year, the product reaches its consumer and is used for 3 years. Thus, in the fifth year, the product is returned for recovery. Components are replaced with washed parts (reuse) and used for 4 more years after which it returns for recovery again. The colors explain the point of time for the activity. These colors are just for explanation and not the actual colors to be used.*

*This line showcases two possible scenarios for the same component. Since the EoL strategy differs on a case to case basis, all possible strategies must be visualised to help the operator decide the further course of action.*

*The first scenario showcases when the part cannot be reused later. Thus, a new part is used as a replacement and the worn part is scrapped. The EoL of scrapping is unknown but can be found with some research and updated in this visual.*

*The second scenario showcases a possibility when the part can be replaced with an old washed part (in essence, reuse) to facilitate remanufacturing of the whole pump. This can be done for all parts and all possible EoL scenarios.*

*Good thing to incorporate especially since there is potential that all stakeholders could be the same entity (manufacturer, recycler etc)*

KERN

ALT 220-5DAM

14/03/22 Weighing

21.50260 g

0%

Max 60g/220g d=0.01mg/0.1mg
Min 1mg e=1mg

ON OFF | F | UNIT | PRINT SET | TARE →0← ESC


LOAD
588
980
1471
LOAD N
SYSTEM
AFFRI
HARDNESS TESTER
76.5
ON
SET
TOL
MEM
ON/OFF
ESC
DEL
OFF
STAT
%
SCALE
SCALE
AFFRI® SYSTEM
History
Settings
UP
OMAG®
HARDNESS TESTING INSTRUMENTS MANUFACTORY
AFFRI GROUP
Model: 206 EX
Serial: 74615
Volt: 115 - 230
Weight: 54 Kg
DISTRIBUTOR
OMAG di AFFRI DAVIDE s.r.l.
21056 Induno Olona - VA - Italy
Tel. (+39) 0332.200.546
Fax (+39) 0332.203.704
www.omagaffri.com
info@omagaffri.com
MADE IN ITALY

beitsinformation

VP
Prüffarbkategorie

BOSCH

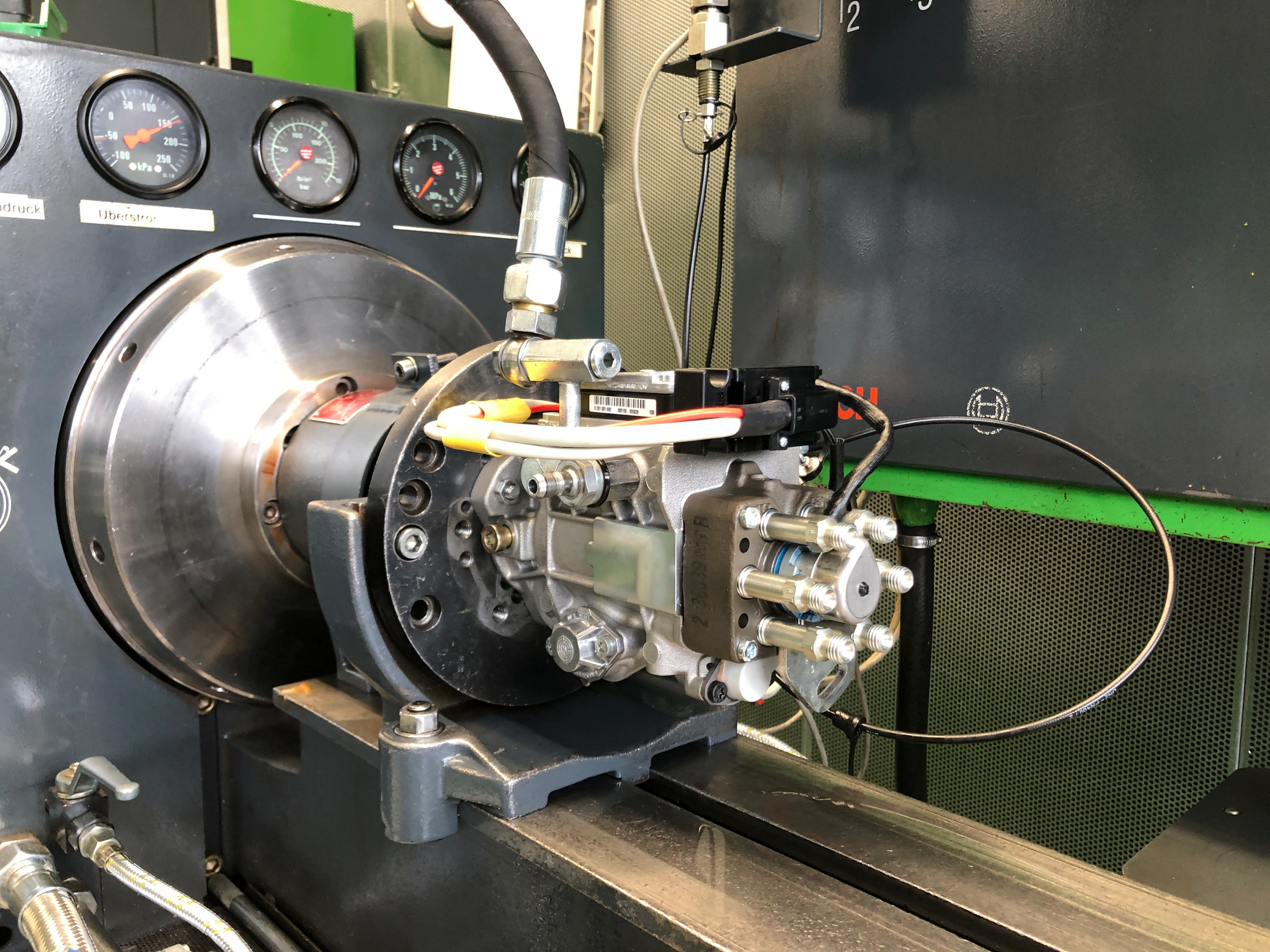
Pumpen-Innenraumdruck

Überström

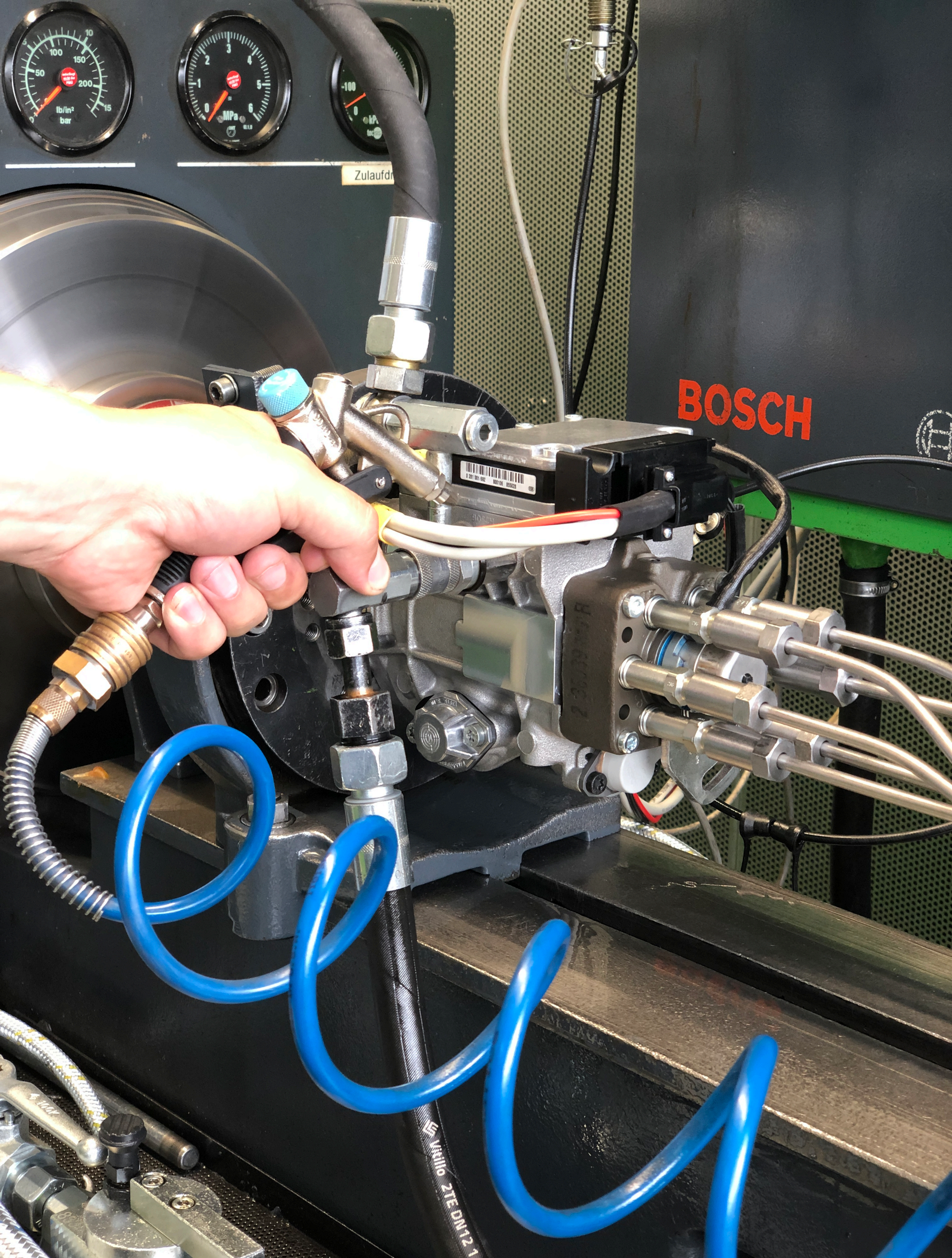
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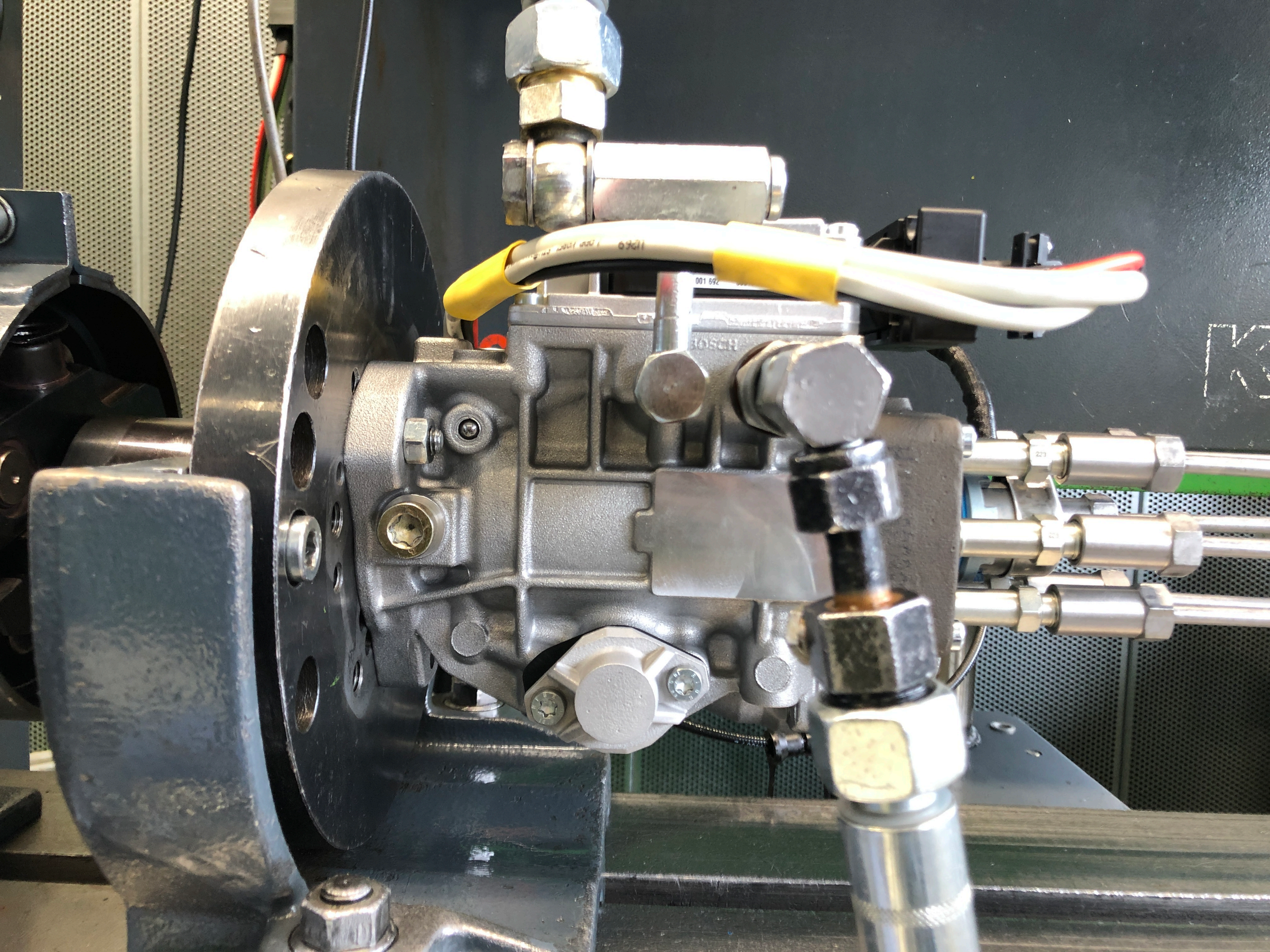
NACHARBEIT

1.2
2.2
3.2
4.2
5.2
6.2


kPa
Überstrom


BRILLIANCE 150P2
Press CTRL + ALT + DELETE to log on
Windows Embedded
POSReady 7
PHILIPS
BOSCH
2K37K0
VP
Prüffarbkategorie
Achtung
24V
12 V
Pumpen-Innen
lenovo
BOSCH
KMA 822


lb/in²
bar
MPa
Zulaufdr
BOSCH
0 281 001 692
Viktillo 2TE DN12 1/2


BOSCH

# LOCKING COVER

Conventional

- Tool Steel Production
- Aluminium Production
- Transport to Ritter Factory
- Transport to Ritter Factory
- Mould Production
- Pressure Die Casting
- Finishing (Stamp Deburring)

3D Printing

- Aluminium Powder Production
- Transport to 3D Centre
- DMLS 3D Printing
- Finishing (Sanding)

Excluded Overall:

- 3D Printing Machine
- Casting Machine
- Forging Machine
- Consumables like argon, lubrication agents etc.
- Water Usage
- 2nd degree electricity

- Part Testing
- Transport to Karlsruhe
- Transport to dealer
- Transport to end user
- Part Use Phase
- Transport to KOSH
- End of Life

**LEGEND**

INCLUDED

# CAM PLATE

Conventional

- Tool Steel Production
- Alloy Steel Production
- Transport to Wezel Factory
- Transport to Wezel Factory
- Die Production
- Forging
- Finising (Grinding)

3D Printing

- Maraging Steel Powder Production
- Transport to 3D Centre
- DMLS 3D Printing
- Finising (Grinding)

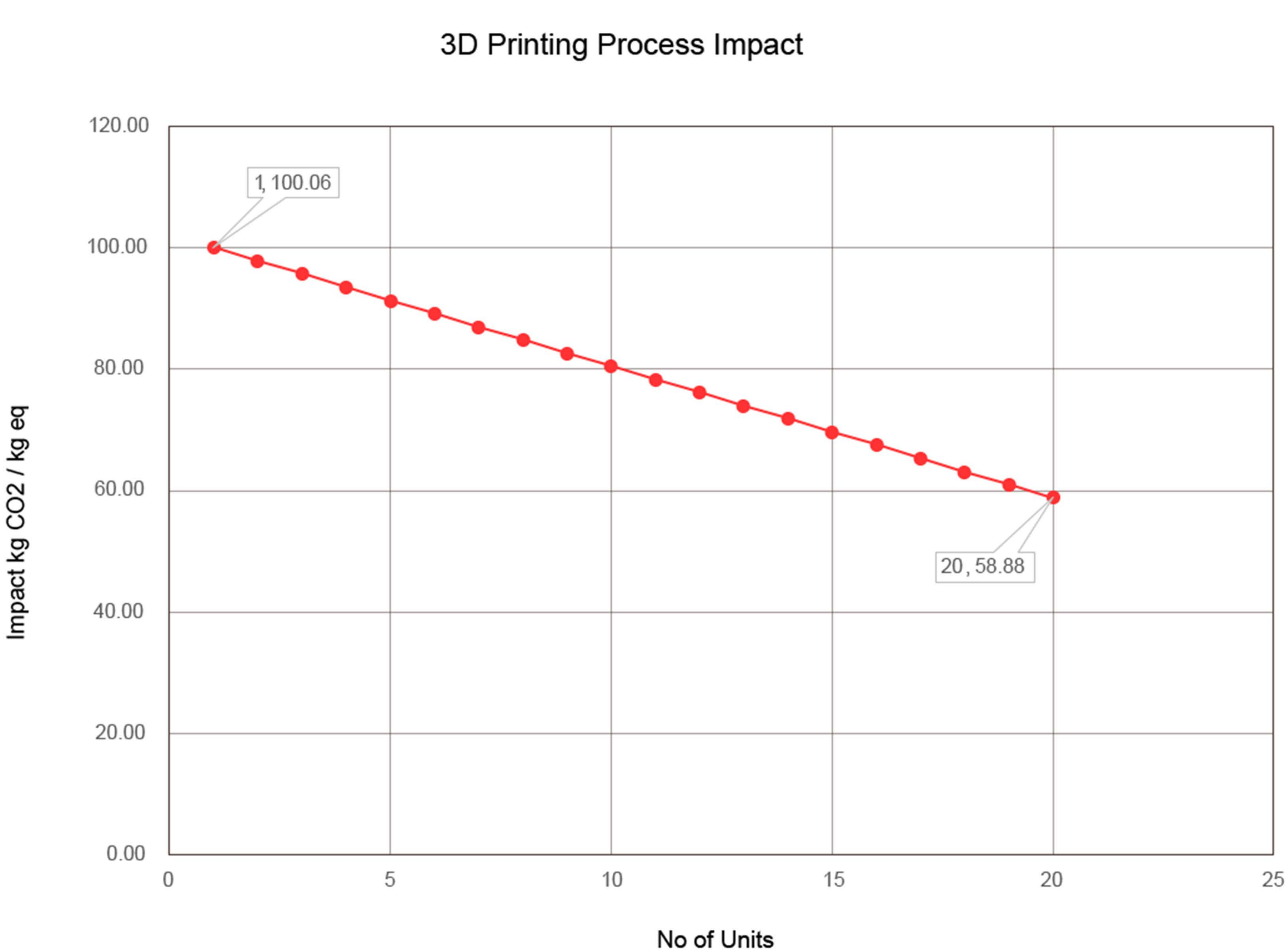
Excluded Overall:

- Other finishing processes for conventional cam plate and 3D printed parts
- Straight Pin

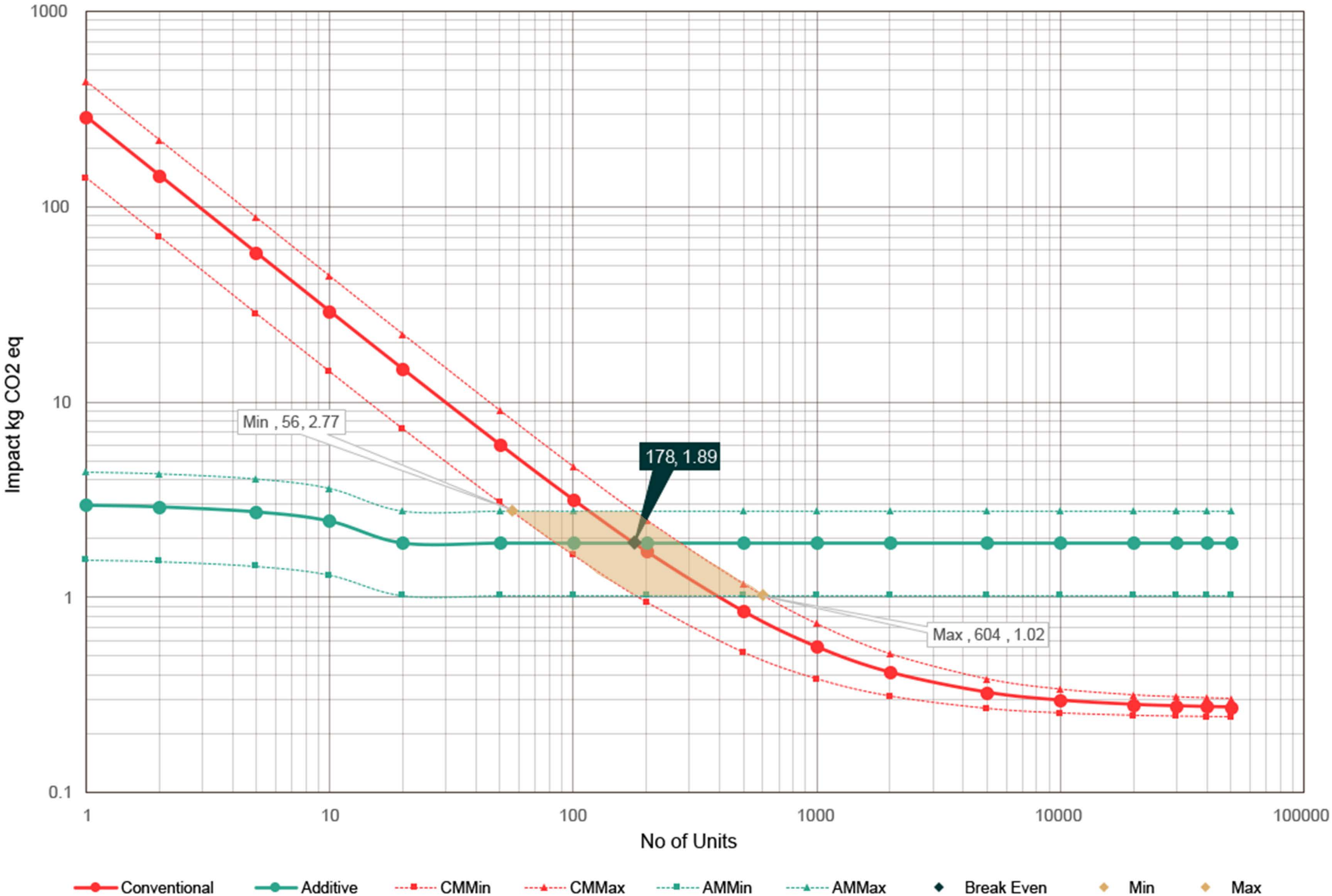
- Part Testing
- Transport to Karlsruhe
- Transport to dealer
- Transport to end user
- Part Use Phase
- Transport to KOSH
- End of Life

**LEGEND**

INCLUDED


3D Printing Process Impact
120.00
100.00
80.00
60.00
40.00
20.00
0.00
Impact kg CO2 / kg eq
1, 100.06
20, 58.88
0
5
10
15
20
25
No of Units

# Environmental Impact per Part (w/ uncertainty)



# Environmental Impact per Part (w/ uncertainty)

Imaact kgCO2 eq

1000
100
10
1
0.1

Min , 71, 2.77

250 , 1.89

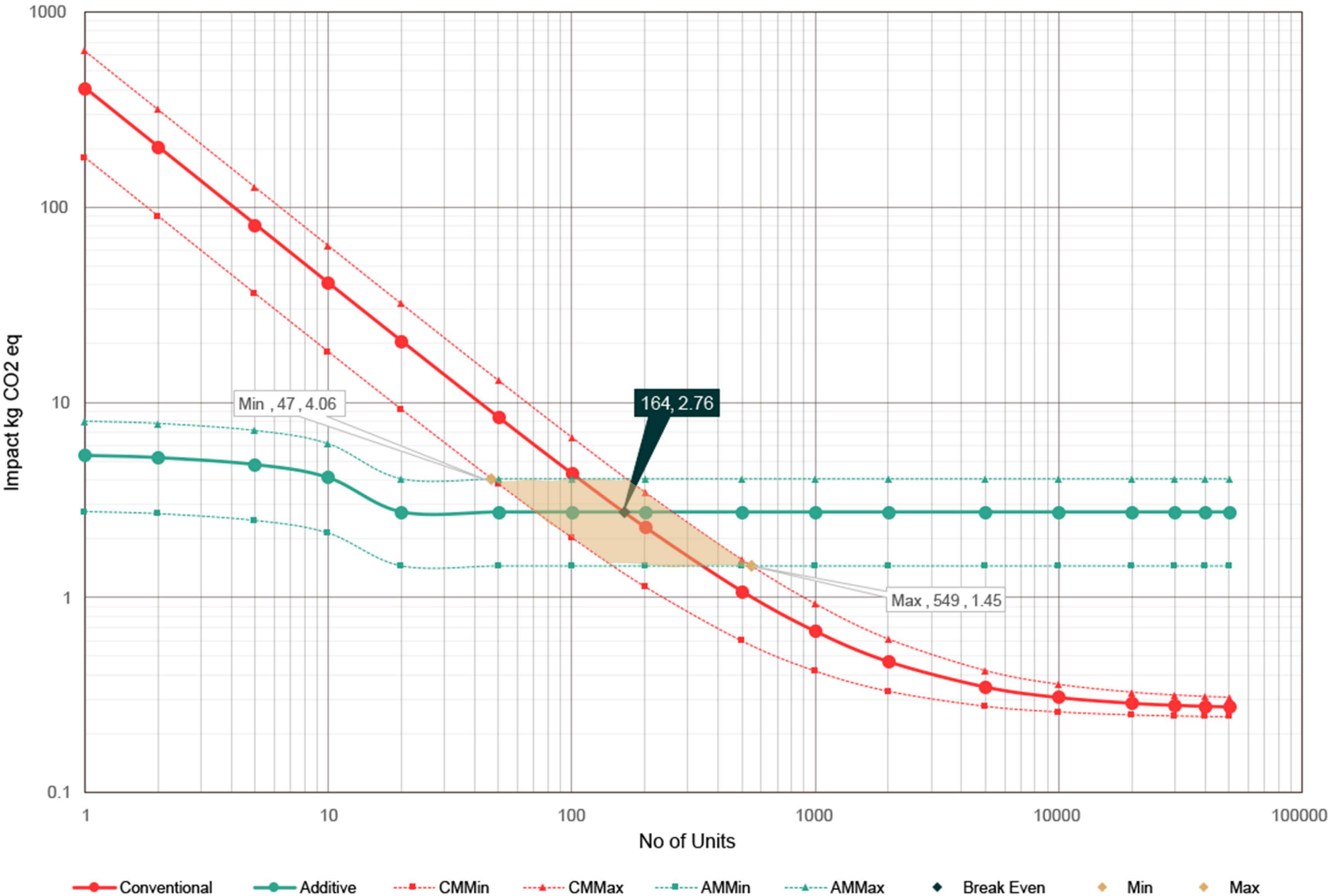
Max , 874 , 1.02

1
10
100
1000
10000
100000

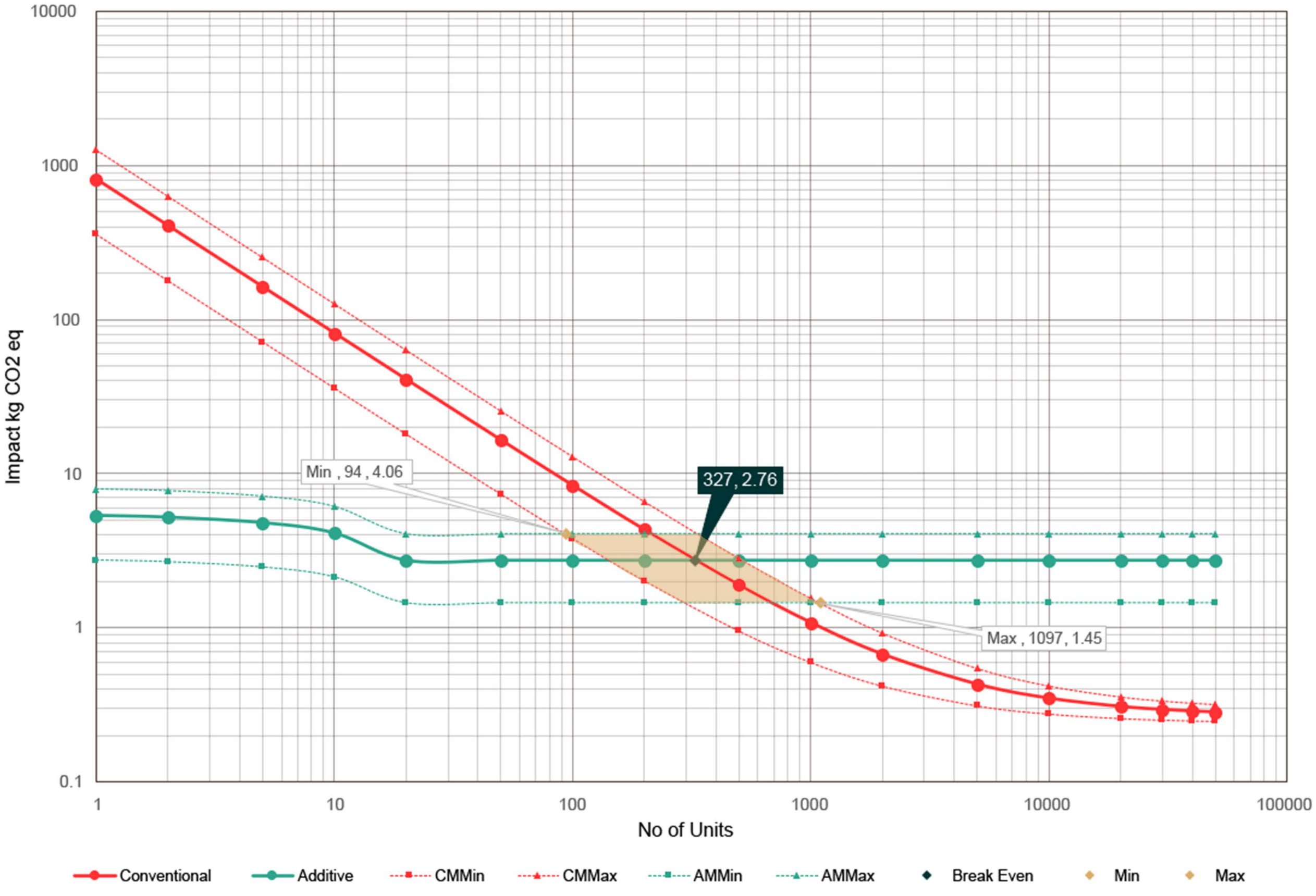
No of Units

Conventional
Additive
CMMin
CMMax
AMMin
AMMax
Break Even
Min
Max

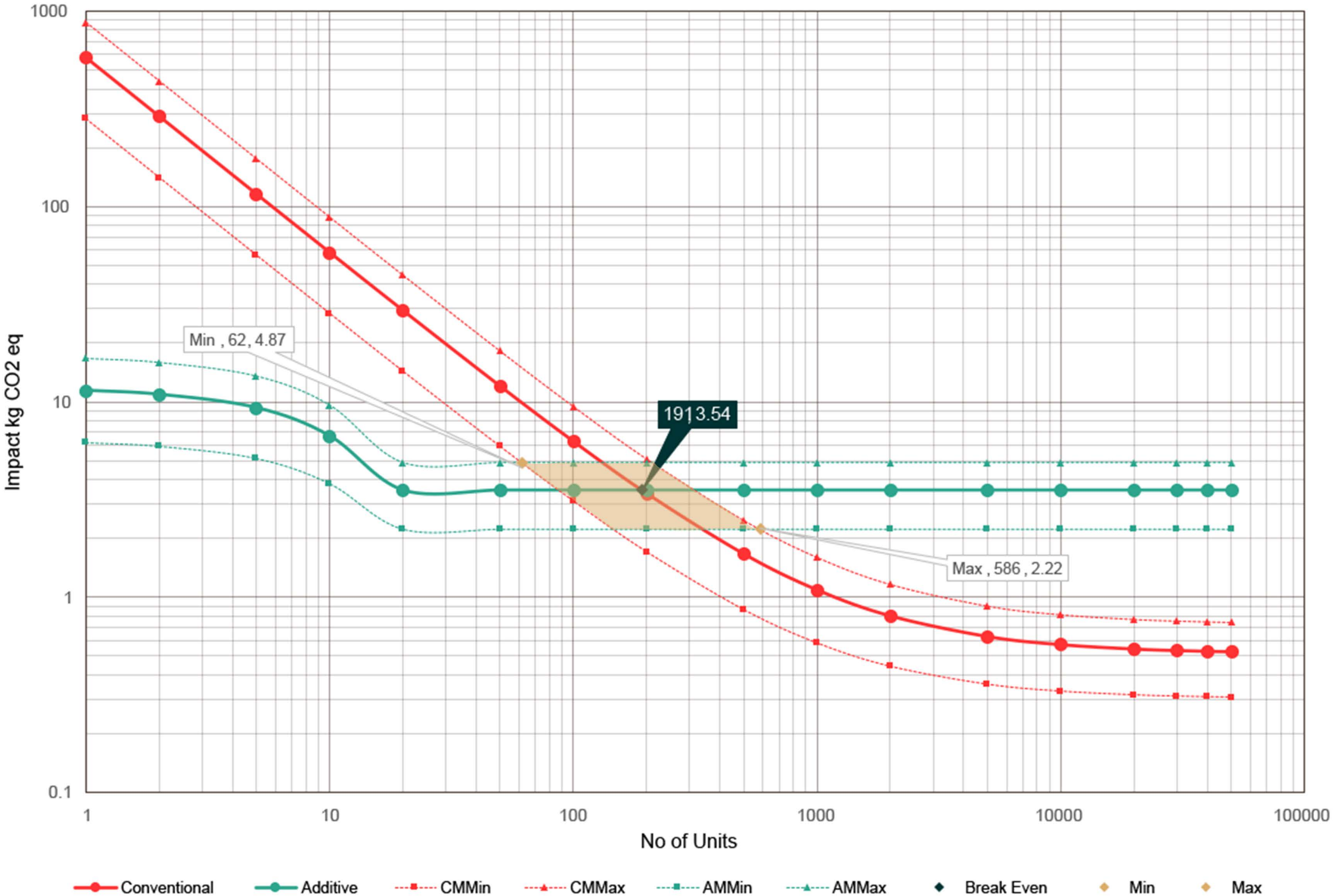
# Environmental Impact per Part (w/ uncertainty)



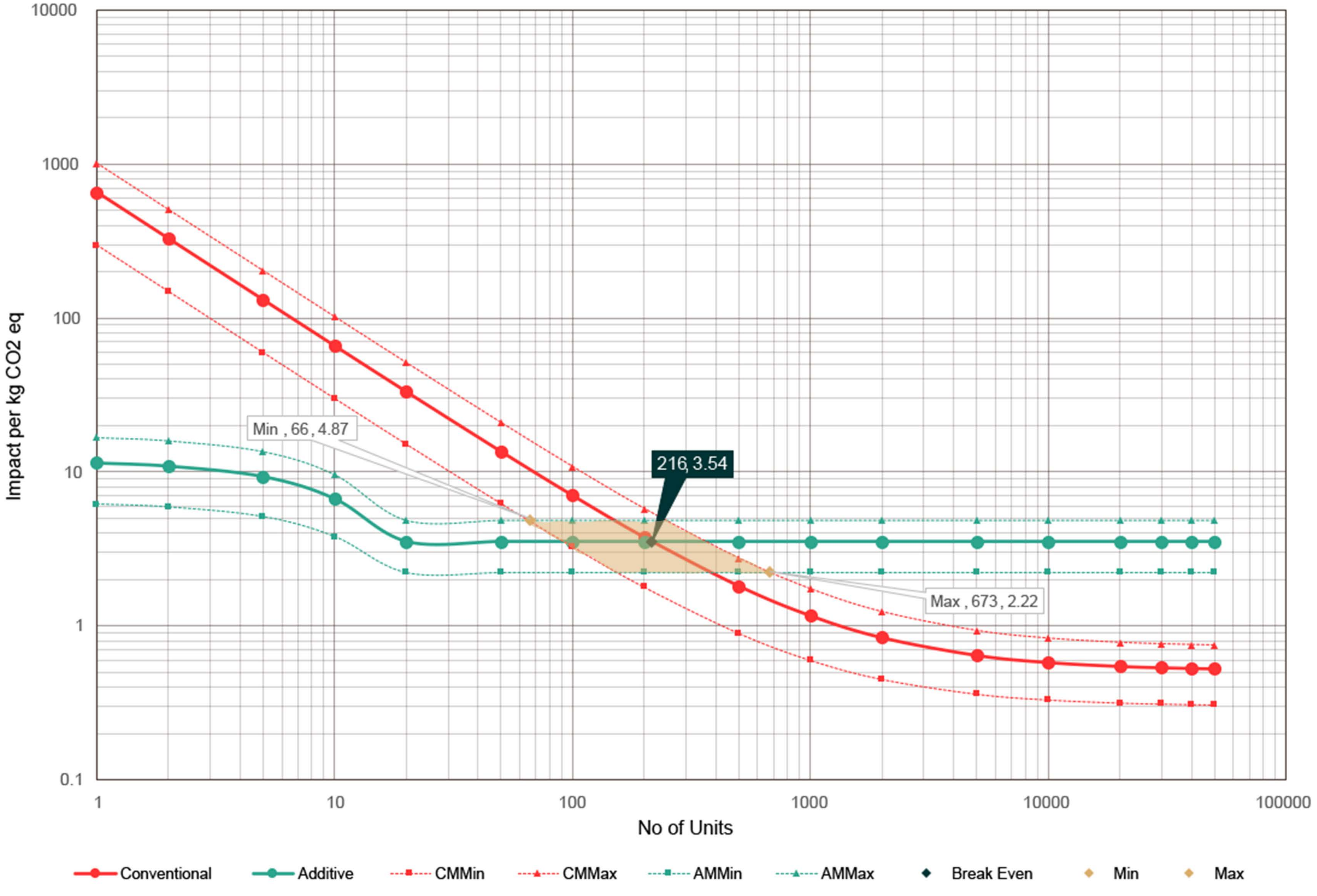
# Environmental Impact per Part (w/ uncertainty)



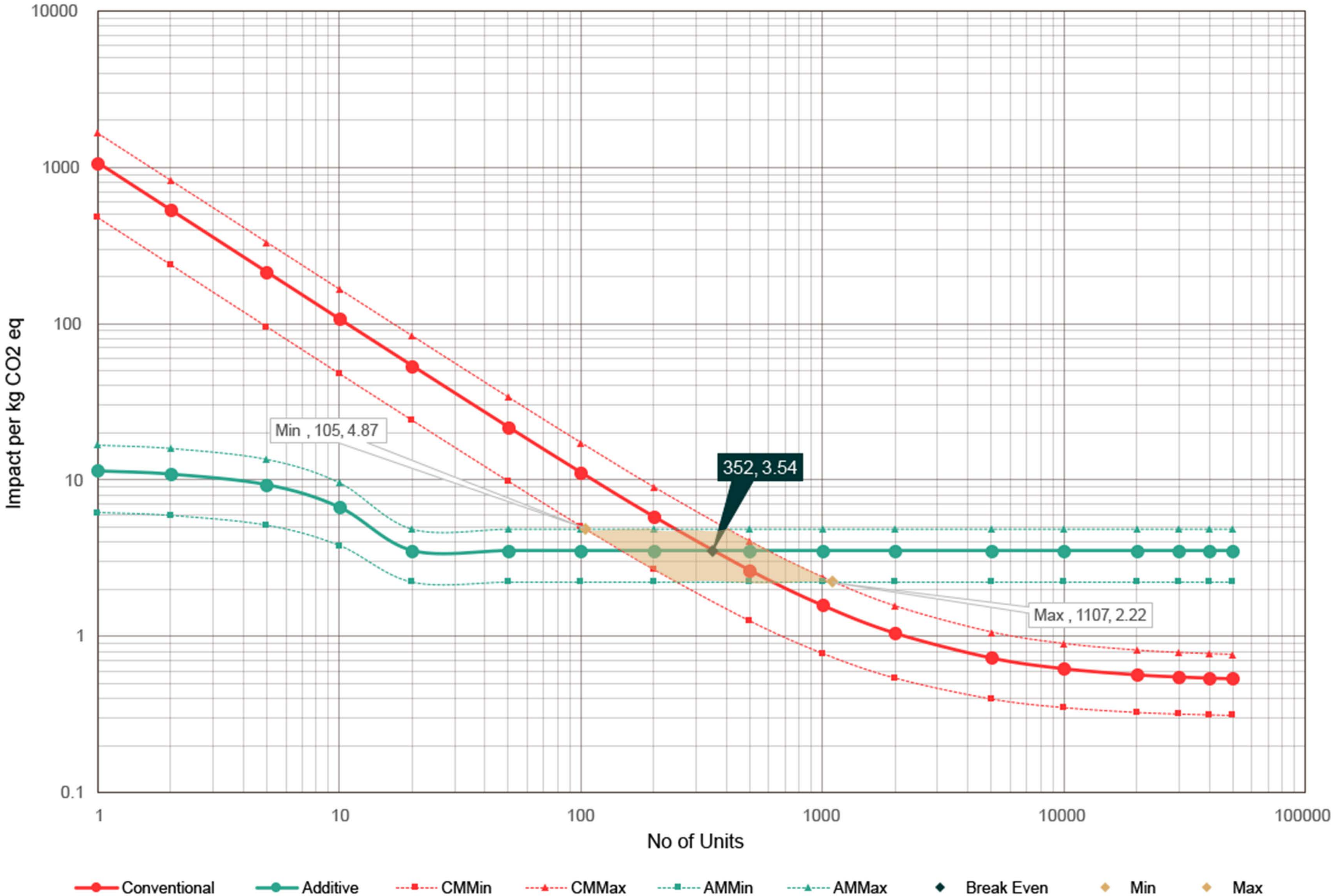
# Environmental Impact per Part (w/ uncertainty)



# Environmental Impact per Part (w/ uncertainty)



# Environmental Impact per Part (w/ uncertainty)



# 3D PRINT INVESTIGATION FLOWCHART

Metal 3D Printing for manufacturing of existing spare part designs with limited minor design changes using DMLS at in-house or familiar metal 3D printing facilities

