DAIMLER

Powertrain Requirement Specifications Part II Mechanical Components

Version 2021

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1 General Information

1.1 Preface

All new procurement projects at Daimler AG are characterized by very demanding cost-reduction targets and by extremely high requirements with regard to the productivity of the production equipment.

In addition to the manufacturing-related optimization of the workpieces, there is an ongoing detailed revision of the technical standards of the production equipment.

The results are recorded in the following specifications:

➢ **Powertrain Requirement Specifications Part I**	**General Information**
➢ **Powertrain Requirement Specifications Part II**	**Mechanical Components**
➢ **Powertrain Requirement Specifications Part III**	**Electrical Components, Control Technology and Production-Oriented IT Systems**
➢ **Powertrain Requirement Specifications Part IV**	**Production Equipment**
➢ **Powertrain Requirement Specifications Part V**	**Documentation**
➢ **Powertrain Requirement Specifications Part VI**	**IT Security**
➢ **Powertrain Requirement Specifications**	**Workpiece-Specific Scope (created individually by the planner)**

The individual specifications may deviate from the optimum solution, but are considered as an economical measure within the overall system.

As a basic rule, any suggestions from our suppliers to improve the availability of production equipment or provide potential savings will be given careful consideration. If you have any such suggestions, please raise them with Daimler AG via the contact specified in Chapter 1.4.

1.2 Validity and Obligations

These requirement specifications define the production equipment specifications "Mechanical Components" for all production-sites and centers in the divisions

- Mercedes-Benz Cars Powertrain (abbreviated as "MO") of Mercedes-Benz AG and
- Daimler Trucks Powertrain (abbreviated as "Trucks") of Daimler Truck AG

and jointly referred to as "Daimler" in the following.

Compliance with the requirement specifications is binding and shall be confirmed in the bids.
The requirement specifications valid at the time of the contract award are binding.

The requirements of MBN9666 shall be met. The specifications in these requirement specifications supplement the requirements of MBN9666. If the requirements from MBN9666 contradict the requirements of the requirement specifications, the requirements of the requirement specifications shall be met.

If the vendor feels that deviations are required with regard to the individual points, this shall be indicated in the bid and approved in writing by Daimler.

The contractor shall ensure that all parties involved in the contract adhere to the latest Daimler regulations.
This tender document may not be disclosed to third parties without the prior consent of Daimler!

1.3 Record of Revisions

Version:	Last revised:	Chapter:	Changed by:
2020	March 2020	**3.6. Reduced Speed in Fluid Power Systems (pneumatic/hydraulic components)** • New description for the implementation	Work package 1.2: Mechanical Components
		5.2. Compressed Air Supply • Compressed-air supply system – main shutoff valve near the maintenance unit • Designation of locked and continual compressed air	Work package 1.2: Mechanical Components PT/SUM
		9.1. Cooling Lubricants – General Information • Fine-grained dirt part in cooling lubricants • Colored marking of shutoff and control devices (CARS)	PP/PTU Work package 1.2: Mechanical Components
		10.5. MQL Technology • MQL unit technology selection	Work package 1.4 Production Equipment
		28. Energy Supply: Compressed Air, Coolant and Heat Supply • Supplied substances compiled according to plants in Appendix 14	Work package 1.2: Mechanical Components
		29.1. Cooling in General • Coolant line pinched as agreed	Work package 1.2: Mechanical Components
		31.2. System Component Cooling Lubricant Central Lines • Cooling lubricant central systems: complete overhaul	PP/PTU
		31.4. Machine Air Extraction Systems • New chapter on machine air extraction systems	PP/PTU
2021	March 2021	**1.3.1.1 Component Approval Systems (BFS)** **1.3.1.3 Component Approvals Using DEEP (Digital Engineering Equipment Portal)** • New system for component approvals	Work package 1.2: Mechanical Components
		3.6. Reduced Speeds in Fluid Power Systems (Pneumatic System/Hydraulics) • Updating of standards, specifications, guidelines	Work package 1.2: Mechanical Components
		7.2 Central Oil Lubrication System • Reciprocating piston distributor now available for all as an additional option • Description of the monitoring system adapted	Work package 1.2: Mechanical Components
		7.3 Central Grease Lubrication System • Reciprocating piston distributor now available for all as an additional option • Description of the monitoring system adapted	Work package 1.2: Mechanical Components

Version:	Last revised:	Chapter:	Changed by:
		• Individual lubrication points with permanent lubricant dispensers if agreed	
		21.1 Erection / 21.3 Erection Elements • Baseplates are no longer provided by Daimler • Chapter moved to Part 1 General	Work package 1.2: Mechanical Components
		29.1. Cooling in General • Other materials as coordinated	Work package 1.2: Mechanical Components
		29.3 Switch Cabinet Cooling with Primary Water Circuit • No roof and interior construction now for all	Work package 1.2: Mechanical Components
		31.4.3.5. Wet Separator • Supplement for compliance with the Legionella Ordinance	Work package 1.2: Mechanical Components
		Various chapters: **28.3.2. Heat Cycle Requirement Profile (Process Heat/Thermal Heat)** **14.3 Leaktightness Test Stands** **19.1 Spindle and Bearing Monitoring** • Harmonization of validity → A E F	Work package 1.2: Mechanical Components

1.3.1 Changes from Version 2020 to Version 2021

Any changes in the Function Descriptions and significance from the previous version are indicated as follows:
- Newly added text is underlined (and also appears in blue in the file).
- Deleted text is ~~crossed out~~
- In both cases, the lines / paragraphs concerned are marked at the left margin by a vertical line.

Changes made for editorial reasons are not marked.

1.3.1.1 Component Approval Systems (BFS)

Use of the respective component approval systems (BFS) must be requested from the person responsible for the project management when the bid is awarded.
At the moment, the MDM and DEEP systems are provided by Daimler for the Powertrain plants.

1.3.1.2 Component Part Approvals via the Material Data Manager (MDM) Online Database

The respective current component part approvals are available online via the Internet database "MDM – Material Data Manager".
Link: www.materialdatenmanager.de

The following applies to all Powertrain MO locations:
- The approved components are stored in the relevant project. These projects are located under the structure → Project structure → Daimler Plants → Plant XXX → Shop → Building → Manufacturer → EQ number → Sub-EQ number (if any). This structure can vary depending on requirements.
- Enablement is required to view the project. This shall be requested via the representative. If the project has not yet been clearly defined, access is possible using a token. This is provided by the representative.
- The parts lists shall be transferred from the joint CAD project Electrical components/Fluid with Eplan P8 via the EPLAN/MDM interface 2 into the MDM. The check on approval and the requesting of the special approvals shall be done by the contractor in the MDM.

- The parts lists for the mechanical components shall be uploaded via Excel. (In the MDM, in the strap parts list, there is a template.)
- All deviations for the approved component parts in the project require a special approval that call for the power train MO locations via the MDM in the project structure.
- All component part manufacturers that are represented in the parts list shall be documented in the MDM and have an assignment. The error "Manufacturer not found" shall not occur.
- For each parts list import, the accompanying plan shall be uploaded in the MDM as a navigable, searchable PDF.
- For the circuit diagram approval, the parts lists shall be uploaded and marked "valid". With the uploading, the link in the infomail (about the completed parts list import) shall be used by the MDM to create a task for the responsible operator.

Caution: Should you see data records in the "Material approvals" structure or in the "Project structure" written in italics, they are not approved. (The same also applies for viewing the catalog in the "Component Part Manufacturer Including Accompanying Data" view.)

In the Truck area, the procedure is different. Work is performed either in the MFL structure or as described above in the project structure. Please clarify this at the project start.

1.3.1.3 Component Approvals Using DEEP (Digital Engineering Equipment Portal)

The currently applicable component part approvals are accessible online via the DEEP Internet database
Link to DEEP via the Supplier Portal

- The approved components are stored in the relevant project. These projects can be found in the DEEP structure. This structure can vary depending on requirements.
- The contractor can invoke DEEP through the Daimler Supplier Portal and will then be assigned the access details and roles applicable to his order.
- The parts lists must be transferred from the joint CAD project Electrical components/Fluid with Eplan P8 via the device lists and SLE into the DEEP database. The check on approval and the requesting of the special approvals shall be done by the contractor on DEEP.
- The parts lists for mechanical, electrical components and fluid power systems are to be merged in the SLE database.
- Any deviations from the approved component parts in the project require special approval. These special approvals must be applied for via DEEP.
- For each special material approval application, the current E-Plan must be uploaded to DEEP as an accessible, searchable PDF.
- For circuit diagram approval, the circuit diagrams themselves and the associated device lists must be available on DEEP.

The complete guidelines on material approval list/documentation will be provided by Daimler upon request.

1.4 Contacts

For general, content-related questions regarding understanding of the requirement specifications,
send an e-mail to the address below:
LH2-Mechanik@daimler.com
If you have any order-specific questions, please contact the client's representative
(as per the WV/DV-compliant procedure).

1.5 Identifications for Sites and/or Scopes of Validity

Unless otherwise indicated, the chapters/sections are valid for all locations and/or scopes of validity.

Examples:

- The chapter on power packs for supply and disposal systems has a limited scope:

...

Power pack for supply and disposal systems	5

...

- The text passage applies to one location only:

...

In deviation from Appendix 22, a current measurement facility to be agreed upon separately shall be implemented for systems larger than 100 kVA. current measuring setup is to be agreed upon separately, in deviation from Appendix 22.	Y

...

- The blank or missing identification field on the right indicates text that applies from here on to all locations and all scopes of validity:

...

2.1.1.1 Machine Connections

...

1.5.1 Locations

If validity is limited, the sites for which the chapter / section is **valid** are indicated as follows:

Code	Meaning
A	Plant 010 (throughout)
E	Plant 040, Berlin (MO)
F	Plant 068, Hamburg (MO)
G	Not assigned
W	Not assigned
X	Plants 030, 034, in Gaggenau, Axle production center/production center for converters, parts, sheet metal/Transmission production center (Trucks)
Y	Plant 069, Kassel, Axle PC (Trucks)
Z	Plant 020, Mannheim, Engine production center (Trucks), Foundry production center (Trucks)

1.5.2 Scope of Validity

If the scope of validity is limited, the corresponding chapters / sections are identified as follows:

Code	Meaning
1	Mechanical production incl. machine linkages
2	Assembly incl. machine linkages
3	Test stands
4	Handling technology, sorting magazines, stock, shipping
5	Supply and disposal systems
6	Standard production equipment with workpiece-bound equipment and additional automation Clock-pulse controlled, automatically controlled installation, with impact on K factor Using large and medium standard control panels and control panel interface for connection to MDE/BDE SCADA system
7	Standard production equipment with workpiece-bound equipment and additional automation Clock-pulse controlled, automatically controlled installation, with impact on K factor
8	Standard production equipment
9	Washing machines

The range of validity of the requested machines has to be taken from the RFQ or requested from Daimler.
Codes 1 to 5 meet the requirements for all special machines as per MBN 9666-1.

1.6 Special Components

If components that are subject to special approval are used, it shall be ensured that these or 100% compatible components can still be procured for a period of 10 years after confirmation of absence of defects. If this is not possible, for each of these critical components a replacement part shall be supplied.

If components are subject to customer protection at the manufacturer, they shall be replaced by standard components. If this is not possible for technical reasons, such protection shall be lifted to allow us to procure replacement parts. If it is not technically possible to replace components with standard components, the supplier shall revoke any customer protection for our provision of parts, including for all components that the supplier did not manufacture itself but instead arranged to have developed on its behalf by a third party or that were

developed together with the supplier and a third party, which means that the component can be ordered directly from the manufacturer. Affected components shall be separately listed and submitted for approval...."

In the case of the demonstrable failure to provide such delivery, Daimler reserves the right, even after such a period has elapsed, to charge the machine supplier for the conversion costs which become necessary owing to the non-availability of replacement parts.

If the subsequent machining of purchased and standard parts cannot be avoided, then the component in question shall be correspondingly identified in the parts list and the production/modification drawing shall be supplied.

2 Machines and Systems

2.1 General

1 2 3 4 5 6 7 9

1. Replacement of standard mechanical components, like drive pulleys, chains, guards, etc., shall be possible without the need to disassemble electrical components.
2. Rolled plain DU bearing bushings and spherical bushings shall be used only for secondary functions.
3. Labels shall be attached permanently according to the point of use and the substances used. Alternatively, laminated photographic labels may be used (stored close to the site A4 file divider at the machine), e.g. in dry machine areas outside working compartments.
4. A manual safety prop arrangement for repair and maintenance on inclined and vertical equipment shall always be provided. An agreement shall be reached with the representative on prop locations. An electrical scan for presence at storage location in accordance with Requirement Specifications for Electrical Components, Section 2.7.2.5 shall be provided.

A E F

X Y Z

5. The following applies to MO: If the machine components are not damaged due to unintentionally inserted pins after recommissioning, electrical safeguarding at the storage location can be omitted.
6. The following applies to Trucks: All of the equipment manufacturer's substance interfaces to Daimler shall be labeled in plain text, showing the direction of flow.
7. If transmissions with shrink-fit seating (all versions) are used on vertical axes, the upper position of the axis shall additionally be polled by means of a proximity initiator if a travel measurement system is not used. This switch shall be monitored for correct functioning.
8. The country- and site-specific requirements of the AwSV (ordinance on systems for handling substances detrimental to water quality) for the installation of systems (collecting pans, drip pans; see Appendix 03) shall be observed (hydraulics, oil in general, lubrication, cooling lubricants, washer fluid, sealants and adhesives, etc.). The plant standards should be observed for the design of drip and collecting trays and the system identification. In the case of installation in pits, the water protection measures shall be coordinated in a timely manner with the representative. The specific requirements of the plants, the sites for the details and the design of collecting trays and the anchorage are to be observed.
9. The substance and temperature resistance of all (sealing) materials used (e.g. hoses, lines, seals, scrapers, rollers, etc.) shall be ensured. Materials according to VDI 3035 (see Table 3) shall be used. Deviations shall be documented.
10. When stationary and in the event of pressure or power failure, vertical and inclined units may not slide down on their own.
11. Threads on aluminum components that transmit force (carriers, brackets, grippers, base plates, fixtures, etc.) shall always be designed with threaded inserts. In case of deviations from this, verification of the tensile strength of the material used shall be provided.
12. Pump drives in pulsed processes or with variable operating points with an output of 7.5 kW and higher shall be equipped with a frequency converter (except return pumps for chip-laden substances: chip sedimentation may occur here).
13. To precisely reproduce the position/installed position after a compact unit has been replaced, end stops shall be attached in an axial direction (e.g. cylindrical pin).
14. The use of assembled adjusting elements (feeler gages, feeler gage packs, adjusting washers) to align machine elements is not permitted. For each adjustment position, only one adjusting shim that has been ground to the required dimension may be used.

15. Drive and transport chains shall be labeled on-site with the chain type and length.
16. Adherence to DIN EN ISO 4413 and DIN EN ISO 4414 is mandatory.
17. Internal piping for the machine (system) shall provide a central connection point for cooling water, cooling lubricant, washing water and compressed air for each machine (installation).
18. Specially regulated approval processes – besides the BFS – must be adhered to at all times; these may not be part of Requirement Specifications 1.2 "Mechanical Components" (e.g. transmission motors, fastener tightening equipment, etc. in requirement specifications 1.3 "Electrical Components")

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2.2 Wearing Parts

If wear parts at Daimler AG need to be changed/optimized in terms of assembly reliability, availability, service life, etc. at any point from commissioning through confirmation of absence of defects, the supplier shall be responsible for ensuring that the necessary reconditioning/new production of the wear and replacement parts can be performed and shall also document this.

1 2 3 4 5 6 7 9

2.3 Adjusting Gage and Aids (Chapter in MBN9666-2)

Where MBN9666-2 -M lays down that hoisting gear also has to be supplied (e.g. for tool changing), this shall be selected as per FGM.

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2.4 Marking of Workpiece at Machines to Aid Erection

The requirement was moved to requirement specifications Chapter 21.1 "Erection of Machines".

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2.5 Counterbalance Weights at Inclined and Vertical Units

1. Counterweights shall be provided with a means for raising with a hoist (e.g. tapped bores for eye bolts).
2. Suitable measures shall be implemented to avoid increased seal wear on the counterweight cylinders (e.g. oiling).

1 6 7 8

2.6 Tool Magazine

1. Protection of tools against dirt in the tool magazine shall be ensured.
2. Penetration of chips and dirt in the tool magazine shall be avoided.
3. Cleaning of tool mounts shall take place directly prior to tool changing. If air jets are required for cleaning, they shall not be activated continuously, but rather only in the corresponding work cycle.

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2.7 Installation of the Machine Tools

Chapter was moved to Chapter 21.3

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2.8 Circulating Pumping Station (RPS)

Prior to bid submission, it has to be clarified whether a circulating pumping station is needed.
For Trucks Gaggenau (W34): Circulating pumping stations are provided by Daimler

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A E F Y Z

2.8.1 Integrated Circulating Pumping Station

1. For a machine switched off via controller ("Machine OFF"), the back pumping station shall continue to be active incl. sensors
2. Own repair switch in black. An information sign shall be affixed on the switch: "Repair switch: The system shall be shut off prior to repair and maintenance".
3. An information sign shall be applied to the master switch: "Caution! Flooding danger. Close manual shutoff devices."
4. If there is a fault in the back pumping station or the back pumping station is switched off, the substance supply shall be automatically closed on the processing machine. Design of the valves: closed without energy requirement, i.e. closing with spring force). The end positions of the supply valve and (if present) the bypass valve on the processing machine shall be monitored. A message/fault shall be generated on the control panel.
5. To protect the return line, a self-closing isolating valve that closes automatically in the event of a power

failure shall be installed downstream of the return pump. The isolating valve is to be designed as a ball valve.
6. The return flow pump shall be technically designed in such a way that
    a. Pressure/suction head shall be sufficiently ensured taking into consideration the back pressure in the central line to be pumped.
    b. The pump operates in the specified characteristic
7. The pump shall be capable of completely emptying the system and shall be designed to withstand dry suction for a short period (slurping pump).
8. It shall be possible to pump back coarse chips. Chips that cannot be pumped shall be crushed to the necessary size by means of suitable installations (chip crusher).
9. The use of cutter pumps is permissible only in processes with chips that cannot be pumped and with quantities < 26 m^3/h.
10. Installation of a manual shutoff device in the return line after the self-closing shutoff device shall be mandatory (minimum distance prior to the pump = 2.5 x d). Additionally, a manual shutoff device shall also be installed prior to the pump if the return flow pump is installed dry. The "open" position shall be electrically monitored for at least one shutoff device in connection with the pump control system (risk of bursting).
11. When using valves in areas where absolute leaktightness is not a requirement, metallic sealing components shall be used.
12. When a back pumping station is used in cleaning systems (except with cooling lubricant or oil), the shutoff devices shall be made of stainless steel.
13. Also see concept drawing in Appendix 11.1.

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2.8.2 Independent Circulating Pumping Station

1. The circulating pumping station has an independent control and its own master switch.
2. For a switched off machine ("Machine OFF" or master switch on machine(s) off), the back pumping station shall continue to be active incl. sensors.
3. An information sign shall be affixed on the master switch: "The system shall be shut off prior to repair and maintenance".
4. An information sign shall be applied to the master switch: "Caution! Flooding danger. Manual shutoff devices of the machine to be emptied."
5. If there is a fault on the back pumping station or the back pumping station is switched off, the substance supply shall be automatically closed on the machine to be drained (interface required).
6. Requirement for automatic start of the system/machine is an operational back pumping station (interface required)
7. To protect the return line, a self-closing isolating valve that closes automatically in the event of a power failure shall be installed downstream of the return pump. The isolating valve is to be designed as a ball valve.
8. Installation of a manual shutoff device in the return line after the self-closing shutoff device shall be mandatory (minimum distance prior to the pump = 2.5 x d). Additionally, a manual shutoff device shall also be installed prior to the pump if the return flow pump is installed dry. The "open" position shall be electrically monitored for at least one shutoff device in connection with the pump control system (risk of bursting).
9. The return flow pump shall be technically designed in such a way that
    a. Pressure/suction head shall be sufficiently ensured taking into consideration the back pressure in the central line to be pumped.
    b. The pump operates in the specified characteristic
10. The pump shall be capable of completely emptying the system(s) and shall be designed to withstand dry suction for a short period (slurping pump).
11. It shall be possible to pump back coarse chips. Chips that cannot be pumped shall be crushed to the necessary size by means of suitable installations (chip crusher).
12. The use of cutter pumps is permissible only in processes with chips that cannot be pumped and with quantities < 26 m^3/h.
13. When using valves in areas where absolute leaktightness is not a requirement, metallic sealing components shall be used.
14. When a back pumping station is used for cleaning systems (except with cooling lubricant or oil), the shutoff devices shall be made of stainless steel.
15. Also see concept drawing in Appendix 11.1.

1 2 3 4 5 6 7 9

3 Engineered Safeguards

3.1 Access to Machines and Systems (see also Chapter in MBN9666-2)

1. The machine shall be designed and built such that all areas that must be accessible for the operation, installation and maintenance of the machine can be safely reached.
   Source: Machinery Directive 2006/42/EC of the European Parliament and Council
2. Elevated work bays and their access points should always be designed such that personnel are not at risk of falling when such areas are used in the intended manner. Inherently functioning installations such as railings, stationary working platforms, footbridges, covers and also three-section side protection shall therefore always be given priority.
   Source: Series published by the German Federal Institute for Occupational Safety and Health (Bundesanstalt für Arbeitsschutz und Arbeitsmedizin)
3. The access concept (operation, servicing, maintenance) shall be described in the bidding phase by the supplier and offered. Coordination with the representative is necessary.
4.
5. If, as per Machinery Directive 2006/42/EC and DIN EN ISO 12100-2, work bays and situations arise in which personnel are at risk of falling, secure standing surfaces shall be designed in accordance with the following requirements:
   a. Design examples: See the decision-making matrix in Appendix 16
   b. Walk-on access areas (machines, platforms, ascents):
      The walk-on access areas shall be fitted with gratings as per DIN 24537 and Appendix 18 – Gratings.
      If this measure is not possible, suitable anti-skid film/alternative measures shall be used.
6. Protection against falling in the form of a railing – including a self-closing door and a sign indicating that access for unauthorized persons is forbidden – shall be provided at the point of ascent. The railings shall always take the form of a permanent installation. Non-permanent designs shall be coordinated in the project with the representative. Design as per DIN EN ISO 14122-3.
7. If the access point needs to be electrically protected, Requirement Specifications III Electrical Components "Guards" shall be observed.
8. Signs shall be installed indicating the maximum load capacities of platforms, ascents, roof/drip pans (see Appendix 03), etc.
9. Areas on which personnel cannot walk shall be clearly indicated.
10.
11. Valid for Plant 69 Kassel: The choice of gratings shall be coordinated with department TM/TA-AS.
12. Permissible installed heights of the components: See DIN EN ISO 14122-2.

Y

1 2 3 4 5 6 7 9

3.2 Securing Vertical Axes

1. When stationary and in the event of pressure or power failure, units may not slide down on their own.
2. If automatic downward movement blocking devices/clamping devices (safety component according to MRL 2006/42/EC) are used, the effect of the downward movement blocking device/clamping device is to be subjected to cyclic testing. The brake function test shall be evaluated in the machine's control system. The procedure shall be described in the operating instructions.

1 2 3 4 5 6 7 9

3.3 Systems Requiring Regular Inspection

Pressure devices and systems must always be procured in accordance with the proven national AD 2000 regulations. These regulations form the basis for a maximum inspection period of 5 years within the framework of the technical safety assessment for recurring inspections. Otherwise the technical safety assessment may determine shorter inspection cycles, e.g. every 2 years.
In this connection, please also observe Requirement Specifications I – General Information.

1 2 3 4 5 6 7 9

3.4 Safety Instructions on Machines

1. Safety instruction signs shall be designed in yellow.
2. Safety instruction signs shall be limited to the absolute minimum required. Excessive signage is to be avoided.

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3.5 Protection against Hose Failure (see MBN9666-5)

A completed hose recording list analogous to MBN9666-5 Chapter 10.6 shall be supplied with the documentation.

3.6 Reduced Speeds in Fluid Power Systems (Pneumatic System/Hydraulics)

Based on a risk assessment, reduced speeds in BA2 and BA3 shall also be applied for pneumatic and hydraulic motions.
It shall be checked whether such reductions may be omitted with traversing motions of less than 80 mm. The results shall be presented on request.
In exceptional cases, the guidelines of VDMA 66416 shall be applied and/or other legally permissible and safe implementation alternatives permitted after consultation with and approval by Daimler representatives. An economical implementation is generally assumed.

The following standards, specifications and guidelines shall be applied for implementing reduced speeds:

- VDMA 66416_2016-01
- DIN_EN_ISO_12100_2011-03
- DIN EN ISO 16090-1_2019-12
- DGUV Information on Reduced Speed in Fluid Power Control Systems, FBHM-058 edition 11.10.2019
- DIN_EN_ISO_11161_2010-10

As a constraint added to the standards, specifications and guidelines, generally the reduced speed shall be limited to 33 mm/s or 2 m/min. Exceptions only by agreement with the Daimler representative.

1 2 3 4 5 6 7 9

4 Hydraulics

1 2 3 4 5 6 7 9

4.1 General

1. When installing hydraulic systems, it shall be ensured that the components are so mounted that any oil leaking is collected. An oil drip tray with ball cock and drain plug shall be mounted under the hydraulic daisy chain.
2. Plain text labeling: Pressures (pressure ranges) at pressure gages, measuring locations and pressure switches (list of parameters). Designations of valves, ball cocks not assignable to another system, as well as filter elements. Equipment identification labels shall be affixed to non-exchangeable parts. The labels shall be attached permanently according to their point of use and the substances used. Alternatively, laminated photo labels may be used (stored in A4 folders attached to the machine).
3. Hydraulic fluids shall be used by agreement of the representative in consultation with the center's departments. When testing the machines at his premises, the machine supplier shall ensure that the oils used for the first filling exactly match the composition of the oils subsequently used at Daimler's plants, i.e. they shall be compatible, free of ash and contain no heavy metals.
4. Information on the quality or type of oil to be used shall be applied to the filler necks.
5. It shall be possible to access and inspect hydraulic units and their components (e.g. pumps, filters, pressure regulators, pressure switches, etc.) while the system is in operation.
6. The following applies to Trucks: Manual shutoff and control devices for fluid flows shall be color-coded at their operating grips depending on function, using a heat-shrinkable tube:
   Red: Closed in automatic mode
   Green: Open in automatic mode

X Y Z

Yellow: Manual process quantity control

7. The system pressure shall be monitored as the switch-on condition for a system.
8. Pressure and flow rate shall be individually adjustable for all hydraulically powered motions.
9. The following applies to Trucks Gaggenau (W34): A measuring connection for purity class determination shall be provided for each major assembly. X
10. Each pressure area shall be equipped with a measuring connection if no sensor with display is installed.
    In the design phase, the use of measuring connections shall be coordinated with the representative.
11. If the walking beam is operated with hydraulic cylinders and hydraulic slewing motors, adjustable stops for the limits of travel shall be mounted.
12. Hydraulic rotary drives for turntables, swiveling cells, etc. shall be executed with an adjustable fixed stop or index for the transfer position.
13. No damage shall result due to overloading at hydraulic drives.

4.2 Hydraulic Pipes and Hoses

1 2 3 4 5 6 7 9

1. For dry and oil-lubricated machining, precision steel pipes to DIN 2391-1 and -2 St37.4 (NBK) phosphated, externally galvanized for corrosion protection shall be used. In areas susceptible to corrosion – due to spray water, condensation and chemicals – stainless steel pipes according to DIN 17458 are specified.
2. Mounting of piping on the floor is not permitted.
3. If there is a danger of mix-up at separable connections of hoses and pipelines, these shall be clearly marked at each disconnection end in accordance with the fluid circuit diagram.

4.3 Pipe Fittings

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If not specifically required, standard pipe fittings of steel should always be used (this also applies if stainless steel pipes are used). The component parts can be found in the MFL (in BFS).

4.4 Hydraulic Valves

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2 3 4 6

1. Valves: The component parts can be found in the MFL (in BFS) + MBN9666-5 under "Electrically Operated Valves")

4.5 Servo and Proportional Valves

1 2 3 4 5 6 7 9

Servo valves and proportional valves shall be used only following consultation with the representative (see also MBN9666-5).

4.6 Pressure Switch (in MBN9666)

1 2 3 4 5 6 7 9

Pressure switches: The component parts can be found in the material approval lists (in BFS).

4.7 Hydraulic Unit > 60 Liters Volume

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1. The hydraulic units shall be designed in accordance with AwSV (AwSV = Ordinance on Installations for the Handling of Substances Hazardous to Water).
2. If hydraulic units with a capacity greater than 1000 liters are to be used, an application shall be submitted to Daimler for approval.
3. Hydraulic unit design as per DIN 24 339 BN cover shape A, oil drain fitting
   with ball valve G1" and plug. Openings for cleaning shall be easily accessible. No components and fittings shall extend beyond the periphery channel.
4. A container (mail box) for the hydraulic plans shall be planned on the hydraulic unit outside of electrical installation spaces. In the case of several identical machines that are installed in close proximity within an operation, a centrally located container (mail box) for fluid circuit diagrams is sufficient. Location coordinated with representative.
5. Hydraulic units with immersed and tunnel pumps are not permissible.
6. Piping and cable ducts shall be routed in such a way that pumps can be easily removed and lifted upwards (note pipe fittings). The above points always also apply to float switches, filters, etc.
7. Clutch radiators shall be considered as heat exchangers and are therefore subject to approval.

8. The hydraulic unit is always to be equipped with temperature-monitoring integrated into the machine control. If a special permit in writing has been granted for hydraulic oil cooling, this hydraulic unit shall be equipped with a temperature sensor integrated into the machine control system and a visual temperature display.
9. A lockable port for checking the pump coupling and a port for checking for oil leaks shall be provided at the pump flange.
10. A filling adapter with fine filter and clogging indicator is required (can be found in the MFL (in BFS)); hole circle diameter in accordance with DIN 24557-2; pipe socket under the minimum oil level.
11. When starting operation, the hydraulic unit shall not cause any time delay (it shall be ensured that the hydraulics temperature is correct).
12. The fill level monitoring and temperature indication units shall be equipped with M12x1 connectors; hole circle diameter in accordance with DIN 24557-2 (the component parts can be found in the MFL (in BFS)).
13. Drive motors for hydraulic pumps of speeds of 1,000 rpm and up may be used.
14. In Mannheim: a filter unit is to be provided in the hydraulic pressure line (10µm).
15. Gaggenau, Mannheim, Kassel plants: floor pans are always required under the hydraulic unit. They belong to the manufacturer's scope of delivery.
16. Mannheim plant: The hydraulic units are installed with a ground clearance (distance between the tray and the floor of at least 120 mm; otherwise see AwSV) to ensure that the areas below them can be inspected and cleaned.

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	Z
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4.8 Hydraulic Filters for Production Equipment

1. Filters are to be designed for a cold start temperature of 15°C.
2. No cold start and pressure peak bypassing of the filter function may be programmed into the electrical control system.
3. If cold-start signal suppression is necessary, this shall be executed with a bimetallic switch in the filter (with hydraulics only).

1 2 3 4 5	6 7 9

4.9 Hydraulic Cylinders

1. The design of the machines shall ensure that the piston rods are retracted to home position (protection against solidification).
2. End position cushioning of hydraulic cylinders is only permissible if it is adjustable.
3. Piston rods shall be secured so they cannot rotate out and become loose.
4. Integrated path measuring systems in the hydraulic cylinders shall be agreed on with the maintenance departments of the Center. They may be used only if permission is given in writing.

1 2 3 4 5	6 7 9

4.10 Hydraulic Accumulators

1. Accumulators with a capacity of at least 10 liters shall be able to be removed using a hoist.
2. Piston accumulators are permissible only in consultation with the representative.

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5 Pneumatics

1 2 3 4 5	6 7 9

5.1 General Information

1. The following applies to all powertrain locations:
   An operating pressure of 5.0 bar is available at the interface. The system shall be operated with this pressure.
   The use of multiple consumers may result in a brief drop in air pressure. For this reason, the system shall also operate flawlessly at a pressure of 4.5 bar. Consequently, the system shall be designed for an operating pressure of 4.5 bar.
2. Pneumatic components (e.g. service units, filters, pressure regulators, pressure switches, etc.) shall be accessible for checking while the system is in operation. This shall be possible without removing guard covers.
3. Plain text labeling: Pressures (pressure ranges) at pressure gages, measuring points and pressure switches (parameter list), valve, non-assignable ball valves and filter element designation. Equipment identification

labels shall be affixed to non-exchangeable parts. Labels in wet or hot areas are to be riveted or bolted in place. Alternatively, laminated photo labels may be used (stored in A4 folders nearby the machine).

4. The following applies to MO: Contrary to MBN9666-4, range identification on pressure gages (red/green indicator areas) shall be omitted.

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5. If there is a danger of mix-up at separable connections of hoses and pipelines, these shall be clearly marked at each disconnecting end in accordance with the pneumatic circuit diagram.
6. The type of electrical valve control shall be coordinated with the representative.
7. The main shutoff and quick-acting air bleed cocks shall be provided with plain language labels. A danger warning shall be attached: Fast depressurization: The system shall be depressurized prior to repair and maintenance work.
8. The following applies to Trucks: Manual shutoff and control devices for fluid flows shall be color-coded at their operating grips depending on function, using a heat-shrinkable tube:
   Red: Closed in automatic mode
   Green: Open in automatic mode
   Yellow: Manual process quantity control

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9. Pneumatic consumers are to be used only after consideration of all economic aspects, such as capital and running costs. These shall be compared with alternative solutions, such as hydraulic and electrical devices.
10. Directional control valves shall be installed on a base plate at an accessible place to facilitate their removal and replacement. A terminal plate is to be provided when using several valves. The parts shall be arranged in such a manner to prevent them from being exposed to cooling lubricant, chips and other harmful influences.
11. The system supplier shall implement suitable measures to ensure that no condensation can form in the components downstream of the air transformer (risk of corrosion).

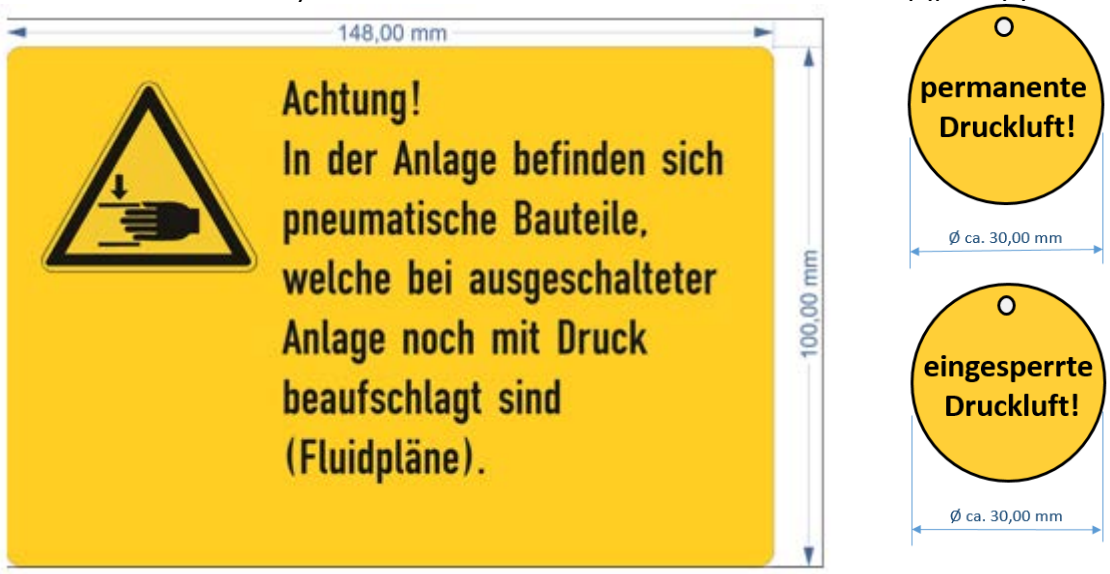
1 2 3 4 5 6 7 9

5.2 Compressed Air Supply

1. The systems are to be operated always with compressed air from the plant network without additional oilers (unoiled compressed air). Exceptions are permitted only in consultation with the representative. This also applies to commissioning at the manufacturer's premises. Operation with oiled compressed air degrades the permanent lubrication (grease) of the components.
2. Central compressed air supply shall be by way of a lockable and pressure-relieved main shutoff valve. Should the main shutoff valve not be installed in proximity to the maintenance unit and accessibly from the floor, the supplier shall install another such valve in proximity to the maintenance unit.
3. When the pneumatic system is switched on, this shall not trigger any unintentional or hazardous movements or switching impacts.
4. The system shall always be unpressurized and vented in the following operating states:
   - EMERGENCY STOP
   - Open safety system
   - Controller switched off

   Before the guard is opened with the locking function, it shall be ensured that the system is vented (monitoring).
   If a continuous air supply is various for different machine functions, the supplier shall take suitable measures to ensure that this maintained on the system. The components subjected to compressed air and/or locked residual energy shall be labeled directly next to the affected components (see also DIN EN ISO 12100; Machinery Directive 2006/42/EC; DIN EN ISO 4414; IFA Information – Safe Handling of Pneumatic Systems; DGUV Information FB HM-065 – Pneumatic Equipment Checklist). In the case of safety guards without a locking function (e.g. contactless safety guards – light curtains), the ventilation shall have two channels. The relevant information shall also be included in the pneumatics plan. The following designation model may be replaced by an equivalent designation by agreement.

Feed/Maintenance Unit **Actuator(s)/Line(s)**



5. The central pneumatic supply shall be within the production equipment, distributed in 2–3 circuits are distributed (see Appendix 10).
   1st circuit: General pneumatic system
   2nd circuit: Manual cleaning
   3rd circuit: Sealing air and presence-of-workpiece sensor (if featured)
6. Maintenance units shall be installed. The component parts can be found in the MFL (in BFS).
7. If the machine manufacturer's risk assessment states that a soft-starting valve is not required, this shall be confirmed in writing to the representative with an explanation.

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5.2.1 Manual Cleaning Circuit

1. A connection for an air-blast gun is to be provided at each machine or, in the event of multi-station machines, between two machining units. arranged on the operator's side. The coupling point shall be positioned close to the machining areas (consultation with the representative is essential here).
2. Cleaning circuits for cooling lubricant and compressed air shall be installed as near as possible to each other.
3. The hose connection point shall be mounted in such a way that it is "near the area of machining". (consultation with the representative is essential here).
4. All piping within the machine up to a ½" ball cock falls within the scope of delivery of the supplier. Sufficient clearance shall be left to guard covers, piping, installations, etc. to permit the installation by Daimler of a quick-fitting pipe union.
5. The ball cock shall be mounted with its outlet pointing downwards.
6. The connection of the air gun line to the central supply shall be located upstream of the electric single spool valve (for maintenance work with the machine switched off).

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5.2.2 Sealing Air, Presence-of-Workpiece and Contact Sensors

1. When the coolant supply in the machine is switched off, after a time delay, all sealing air and the presence-of-workpiece sensors shall switch off automatically.
2. This delay in time shall remain effective even after switching off the control system's power supply and the main switch (pneumatic timer for delayed shutdown; also see Appendix 10).
3. The following applies to MO: Alternatively, delayed shutoff can be implemented via PLC.
4. The time to be set depends on the discharge speed of the cooling lubricant and shall be freely programmable or adjustable.
5. Pneumatic presence-of-workpiece and contact sensors shall be employed only for precision machining operations and then only if absolutely necessary.

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6. Individual setting, individual display and individual inspection of all presence-of-workpiece and contact sensors shall be implemented.
7. In the event of a malfunction: The workpiece shall be automatically unclamped, raised and reclamped (auto-repeat circuit).
8. Should a presence-of-workpiece or contact sensor error warning be issued for just one location, it shall be possible to "acknowledge" this error so that the workpiece can still be traversed out of the fixture.
9. Presence-of-workpiece and contact sensor points shall overlap sufficiently by approximately 3 to 4 mm.
10. If the process requires blow-off cleaning of workpiece support surfaces, this shall be coordinated with the representative.
11. The pneumatic control system shall always be located above the level of the clamping devices.
12. A system for monitoring functions shall be provided (switch monitoring).
13. A graphical depiction of the presence of workpiece and contact points with electrical and pneumatic identification plus the value to be set shall be affixed in the immediate vicinity of the pneumatic control system (aluminum board).
14. On the main and the unit control panels the displays shall implemented as in item 13, with the actual values added. (fault text).
15. The required quality of the sealing air shall be ensured through corresponding measures (also see Appendix 10). If a water separator is installed in an upstream supply system, no additional water separator is required for this circuit.
16. It shall be possible to adjust and measure the sealing air at each machining spindle separately. The measurement shall be performed on the labyrinth ring.
17. The following applies to Trucks: A switch for pressure polling shall be installed downstream of each pressure regulation device.
18. Presence-of-workpiece sensors according to the differential pressure/pressure scale principle: The outflow volume shall be minimized (in the event of operation-related stoppages, the system shall be shut off).
19. The use of presence-of-workpiece sensors is obligatory for dry-machining processes and MQL.
20. If there is a lack of parts at the inlet or the part outlet is occupied, first the cooling lubricant and then the sealing air and the presence-of-workpiece sensor shall be shut off after the set run-on time (energy efficiency).

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5.3 Pneumatic Valve Clusters

1. Valve clusters and valves can be found in the MFL (in BFS) and MBN9666-4 (under "Electrically Operated Valves") and selected accordingly.

1 2 3 4 5 6 7 9

5.4 Pneumatic Cylinders

1. Pneumatic powered movements shall be polled directly.
2. Easy access of piston end position cushioning when mounted shall be ensured.
3. The use of force cells (pressure boosters) is permitted only in consultation with the representative.
4. The following applies to PGE: Pneumatic cylinders for vertical axes with integrated mechanical interlocks shall be selected in accordance with the BFS.

1 2 3 4 5 6 7 9

5.5 Compressed Air Treatment (Maintenance Unit)

1. The component parts can be found in the MFL (in BFS).

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5.6 Air Nozzles

Only air-blast nozzles that use a venturi principle are permissible for use in the assembly and production areas.

6 (Omitted)

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7 Lubrication

1 2 3 4 5 6 7 9

7.1 General Information

1. Lubrication systems shall be installed so that they are readily accessible for servicing and can be replenished during operation.
2. Manual lubrication points (lubricating nipples) are permitted only with the special approval of the representative.
3. The use of flow monitors is permitted only in consultation with the representative.
4. Lubricating lines, metering valves and progressive distributors shall be clearly marked as per the lubrication chart
5. The following applies to MO: Alternatively, laminated photo labels may be used (stored locally in DIN A4 folders near the machine).

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6. Insert sleeves for the attachment of lubrication lines at or in plant components are not permitted.
7. The central lubrication control system shall be implemented using the machine control system.
8. Excess lubrication of the machine/system is to be avoided.
9. Lifetime lubrication is permitted only with the approval of the representative.

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7.2 Central Oil Lubrication System

1. A central lubrication system is the preferred choice, but for individual lubrication points, permanent lubricant dispensers shall be used only with the approval of the representative. The component parts can be found in the MFL (in BFS).
2. Both progressive lubrication systems and lubrication systems with piston-type dispensers are to be quoted as central lubrication types.
3. For single-connector lubrication, maximum and minimum pressure polling is functionally relevant (load change shall take place).
4. Where piston-type dispensers are used, a firmly set pressure switch and a measuring connection shall be mounted in the main line for pressure monitoring (preferably at the end). The pressure switch function shall be evaluated via the control system. Line breakage shall be detectable. When using a progressive lubrication system with several lubrication points, the main distributor must be electrically monitored. An additional monitoring of the secondary distributors is to be preferred in principle, while other concepts are possible after coordination with the representative.
5. Lubricating units over 63 l: Design according to DIN 24 339 BN cover form A. No components and fittings shall extend beyond the periphery channel.
6. No uncontrolled nozzle lubrication is permitted.
7. The working pressure for oil lubrication may not be more than 30 bar.
8. A metering valve shall be provided at each lubrication point.
9. Central lubrication equipment for oil: The component parts can be found in the MFL (in BFS).

1 2 3 4 5 6 7 9

7.3 Central Grease Lubrication System

1. Low-viscosity grease lubrication is permitted only with the written approval of the representative.
2. Both progressive lubrication systems and lubrication systems with piston-type dispensers are to be quoted as central lubrication types.
3. Where piston-type dispensers are used, a firmly set pressure switch and a measuring connection shall be mounted in the main line for pressure monitoring (preferably at the end). The pressure switch function shall be evaluated via the control system. Line breakages shall be detectable. When using a progressive lubrication system with several lubrication points, the main distributor must be electrically monitored. Additional monitoring of the secondary distributors is to be preferred in principle, while other concepts are possible after coordination with the representative.
4. At the pump, a device for operating it manually shall be provided for maintenance.
5. The grease receptacle shall be transparent, with visible grease filling level and designed so that it cannot be overfilled.
6. In the main pipe downstream of the pump, a rupture disk with electrical overpressure switch

shall be provided.
7. The pressure relief line shall be routed back to the pump tank.
8. The grease receptacle must be fitted with a fill coupling (the component parts can be found in the MFL (in BFS)). Overpressure indicators must be mounted on the main distributor.
9. The working pressure may not exceed 120 bar.
10. If oil and emulsion shall be processed, central grease lubrication is not permissible.

1 2 3 4 5 6 7 9

7.4 Individual Lubricating Points

1. If manual lubrication points are approved by the representative,
    a. Lubrication frequency shall not exceed once per month.
    b. Lubricating nipples shall be easily accessible with the machine in its home position and grouped on red-painted mounting strips, at a level which can be reached without aids and without the need to remove covers.
    c. For grease lubrication, threaded hydraulic-type lubricating nipples to DIN 71412 shall be used.
    d. For oil lubrication, threaded cupped-type lubricating nipples according to DIN 3405 shall be used.
    e. One lubricating nipple shall be provided for each lubricating point.
2. For individual lubrication points, permanent lubricant dispensers shall be used only with the approval of the representative. The component parts can be found in the MFL (in BFS).

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7.5 Forced-Circulation Lubrication System

1. At headstocks and headstock transmissions with a forced-circulation lubrication system, an electrical fill level monitor shall be installed in the inspection glass. The component parts can be found in the MFL (in BFS)
2. Oil sightglasses shall be installed in easy view.

1 2 3 4 5 6 7 9

3. External tanks for forced-circulation lubrication shall be equipped with electrical fill level monitors according to MBN 9666-5.
4. It shall be possible for one operator alone to replenish lubricating oil at headstocks and transmissions in a controlled manner.
5. Clamp-attached sightglasses with rubber seals shall be secured against falling out.
6. If hydrostatic and hydrodynamic devices are used, steps shall be taken to prevent any ingress of foreign media.
7. At headstocks, drilling headstocks and headstock transmissions, an external lubricant pump with motor shall be used.

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8. The use of flow monitors for spindles and spindle transmissions is prescribed.
9. If the use of flow monitors is approved, these shall be designed for self-monitoring.

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8 Oil Lubrication Installations

1 2 6 7 9

8.1 Design

1. If a central shop supply system exists, station-related oil reservoirs are to be connected to it (with filling valve, check valve and upstream manual shutoff cock integrated in the station control system).
    a. Oil reservoirs shall be replenished automatically.
    b. The reservoir shall be queried as to "dry run protection", "minimum", "maximum" and "overfill protection".
    c. The replenishment operation shall not prolong station cycling time, i.e. it shall take place during periods outside of the actual oil supply process with interruption of replenishment, if necessary.
2. Oil reservoirs shall be mounted for easy access, with a removable cover for cleaning and servicing.
3. The reservoir shall be protected by a pressure relief valve.
4. For each oil lubrication point, it shall be possible to set the oil quantity and pressure.
5. Oil shall be applied by drip or bead-type feeding. Oil mist lubrication shall be avoided and its use shall be approved only if this can be justified. If oil mist lubrication has to be used for process reasons, the area concerned shall be encapsulated and equipped with an air extractor.

6. Oil application in bores by means of oil slingers is permitted. Precautions shall then be taken to prevent the oil running or being ejected (drip and collecting pans and covers). Oil slingers shall be stopped while they are being traversed into and out of the bore.
7. The oil slinger shall be attached to its driving shaft in such a way that it can be easily removed.
8. The drive shaft for the oil slinger shall only be as long as is required for the oil lubrication operation. The installation dimension shall be affixed to the system in a clearly visible location. (Graphical depiction)
9. If mounted horizontally, an oil slinger with oil retention face shall be used.
10. It should always be ensured that there is no oil carry-over into the machine, onto the conveying system and to subsequent stations.
11. In the basic position, the oil lubrication unit is above an oil collection pan. which can be traversed or placed in position. Their floors shall slope down to a drainage opening with shutoff cock and drain hose.
12. Oil lines from the station reservoir shall take the form of transparent hoses. Spiral hoses are not permitted.
13. Arrangements shall be made for bleeding the system.
14. If system operation means that a high volume of leak oil accumulates in the collecting pan, the oil shall be cleaned (filter) and returned to the system.

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8.2 Metering

1. The oil quantity shall be specified by means of piston-type dispensers or progressive dispensers equipped with exchangeable volume capacity reducers and permanently marked with the respective set volume.
2. If oil mist lubrication has been approved, metering shall be carried out via an adjustable nozzle needle, oil admission pressure and/or valve actuation time.
3. Any systems deviating from the metering systems described here require the approval of the representative.

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8.3 Flow Monitoring Systems

1. No flow monitors shall be used.
2. Positive-action components such as piston-type dispensers or monitored progressive dispensers shall be used. In the latter case, the control system shall be designed to ensure a fully closed circuit.
3. Systems deviating from the flow monitoring systems described here require the approval of the representative.

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9 Cooling Lubricants

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9.1 General

1. The requirement specifications for workpiece-specific scopes state which cooling lubricant is used for operating the requested production equipment.
2. As a rule, the required cooling lubricant is provided from a central system by Daimler AG. Provided substances as per table in Appendix 14; fine-grained dirt part of up to 100 mg/l must be expected. Should a higher filtration quality or higher supply pressure be required, it shall be generated by the machine manufacturer at the production equipment itself by means of automatic backwash filters and pumps from the BFS.
3. In the context of energy-saving objectives, the cooling lubricant supply temperature will be successively increased in the production areas. Desired is a constant inlet temperature of 26°C +/- 1.5 K, which ideally is equal to the shop temperature. It is therefore essential to coordinate the current cooling lubricant inlet temperature in the relevant production area with the representative.
4. In the cooling lubricant line a pressure switch shall be installed. Should the cooling lubricant supply fail, a "Stop at cycle end" (for machining centers: "Stop after tool set") command shall be issued and the main valve closed. To reduce pressure surges for cooling lubricant volumes in excess of 70 m3/h, a bypass regulation system as per Appendices 11.1 and 11.2 shall be implemented.
5. The flow of chips through the machine bed shall be designed in such a way that it is possible to flush the chips away with a very low volume of cooling lubricant (no protruding corners or blind spots in which chip build-up may occur).
6. The consumption values shall be clearly stated in l/min in the bid, giving average and peak consumptions. These figures shall be broken down into consumption rates for high pressure, low pressure and flushing.
7. The purging tubes should be designed in such a way to keep the coolant jet very short. It is important that

the flushing action is not attained due to the quantity of cooling lubricant, but rather due to a directed flushing jet.

8. Long cooling lubricant flushing pipes shall be adequately attached so that they cannot become dislodged or misaligned.
9. Ball valves with a fixed stop or gates are prescribed only wherever the cooling lubricant flow rate has to be set. When they are used, they shall be set and documented on transfer of the machine.
10. Manual shutoff and control devices for fluid flows shall be color-coded at their operating grips depending on function, using a heat-shrinkable pipe:
    Red: Closed in automatic mode
    Green: Open in automatic mode
    Yellow: Manual process quantity control

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9.2 Cooling Lubricant Piping

1. Within the production equipment, the central cooling lubricant supply shall be designed in 3 – 4 circuits.
    1st circuit: Cooling lubricant for rinsing tensioning devices.
    2nd circuit: Cooling lubricant for the machining process.
    3rd circuit: For manually cleaning the system.
    4th circuit: For high-pressure cooling lubricant, if required.
    a. To avoid pressure surges, the valves for the circuits shall not close simultaneously.
    b. The arrangement and boundaries of supply can be found in the schematic representation of the central cooling lubricant machine supply in Appendices 11.1 and 11.2.
2. If there is a danger of mixup at disconnectable hose and pipeline couplings, these shall be clearly identified at both ends in accordance with the fluid circuit diagram.
3. The outlets of the main line ports shall always point upwards so the main line will not drain empty in the event of leakage.

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9.2.1 Cleaning the Workpiece Rest Pads (1st Circuit)

1. Flushing of the workpiece rest pads in the clamping devices at low pressure through small bores (see Appendix 2).
2. Air-blast cleaning of the rest pads is not permissible due to noise and formation of a cooling lubricant mist.
3. If presence-of-workpiece sensors are used an additional bore with air connection is necessary (see Appendix 2). The air pressure with the bore open shall be appreciably less than 1 bar.

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9.2.2 Manual Cleaning Circuit (3rd Circuit)

1. At each machine or, in the case of multi-station machines, between two machining units and on the cooling lubricant rundown tank, a connection for a cooling lubricant spray gun shall be provided. arranged on the operator's side. The coupling point shall be positioned close to the machining areas (consultation with the representative is essential here).
2. The piping at the machine up to a ½" ball cock, closed by a plug, is included in the scope of delivery of the machine supplier. Sufficient clearance shall be left to guard covers, piping, installations, etc. to permit the installation by Daimler of a quick-action coupling. The hose with spray gun will be installed by Daimler.
3. The connection of the cooling lubricant spray gun line to the central system shall be positioned downstream of the central valve (V5). The manual cleaning circuit shall be activated during machine setup operations and cleaning.
4. It shall be possible to shut off the spray gun circuit via a central, easily accessible ball cock without influencing the machine's function and without aids.
5. At machines which are loaded manually, a holder for the jet gun draining into the machine bed shall be provided.

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9.2.3 High-Pressure Cooling Lubricant (4th Circuit)

1. At transfer lines, the high pressure is generated in one system for all stations. The system configuration shall be:
    a. Rundown tank.
    b. Automatic backwash filter.
    c. Pump type depending on required pressure level.

2. Centrifugal pumps are permitted up to a pressure of 15 bar.
3. Each immersion pump shall be attached to a plate with four bolts mounted on the tank cover. The pump delivery line shall be integrated into the plate.
4. Piping and cable ducts shall be routed in such a way that pumps can be easily removed and lifted upwards (note pipe fittings). This also applies to backwash filters, manual filters, etc. The pump outlet shall point vertically upwards, with the fitting at the side.
5. Flushing and cleaning functions using high-pressure cooling lubricant are not permitted.
6. For cooling lubricant pressures exceeding 15 bar, a rundown tank shall be provided.
7. In machining units with variable tool usage (tool magazine), the high-pressure cooling lubricant shall be automatically adapted to the tools used in compression stages (e.g. by means of proportional valves; the component parts can be found in the MFL (in BFS)).

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9.2.3.1 Rundown Tank

1. The cooling lubricant units are designed in accordance with the AwSV (Ordinance on Installations for the Handling of Substances Hazardous to Water).
2. For high-pressure cooling lubricant, a rundown tank with overflow and bottom drain is prescribed. It shall be easy to inspect the overflow and it shall be dimensioned in such a way that it can accommodate the full volumetric flow from the feed line.
   For machining centers, the alternative "without cooling lubricant HP tank" (see below) may be used.
3. The tank shall be provided with large cleaning openings that are easily accessible from above.
4. The rundown tank shall be implemented without filling level inspection glasses.
5. Tank and overflow shall be adequately vented.
6. The bottom drain shall be located at the deepest point of the tank.
7. The basin floor shall have an adequate slope to the bottom drain, so no deposits can build up and it can be easily cleaned from above.
8. The tank shall be designed in such a way that no dead zones arise due to continuous filling and drawing off of the substance by the pumps.
9. The cooling lubricant inlet pipe to the tank shall be controlled by a plate or nozzle between the filter and tank in such a way that, with the ball valves fully open, the inlet flow will not be appreciably higher than the installed pump output.
10. Free access shall be provided for hoists for removal of pumps.
11. If pumps are to be removed, there shall be no need to drain the rundown tanks.
12. A rim about 50 mm high shall be provided on the top of the tank.
13. The distance between the overflow and the tank cover shall be at least 150 mm.
14. Filling of the rundown tank from Daimler's cooling lubricant shop circuit shall be implemented as described in the following:
    a. Manual ball cock or shutoff valve
    b. Filter or dirt trap
    c. Orifice plate for throttling inlet flow (see Item 9)
    d. Automatic isolating valve
    e. Level sensor in the cooling lubricant rundown tank with the following switching points
        i. Tank maximum
        ii. Tank minimum
        iii. Pump dry running protection

Components a – d in shall be installed in the order stated in the direction of cooling lubricant flow without fail. The volumetric capacity between "tank minimum" and "dry run protection" must beat least sufficient to allow one working cycle (at machining centers one tool set) to finish without interrupting the process.

Alternative "without cooling lubricant HP tank"

Requirement: High-pressure pump is equipped with frequency converter control. Function description:

1. Machining tool on, admission pressure in machine feed is picked up by the PIS pressure switch (see Appendices 11.1 and 11.2), after which either V5 or V6 opens depending on the removal quantity:
   a) Removal quantity ≤ 70 m³/h: Automatic valve V5 in machine feed opens in throttled condition.
   b) Removal quantity > 70 m³/h: Bypass valve V6 first opens in throttled condition for approx. 60 s in order to ensure through flow of the machine feed and hence a constant cooling lubricant feed temperature and to minimize pressure surges. Approx. 60% of the maximum removal quantity flows through bypass

valve V6 into the bypass line. After approx. 60 sec, V6 closes in the throttled condition and V5 opens simultaneously.
2. At the same time as V5, at least one automatic valve opens in the LP circuit (= overflow active, thereby ensuring a constant cooling lubricant removal of at least 50 l/min from the feed line).
3. Once this removal is ensured, V3 opens (see Appendix 11.1) and the high-pressure pump switches on (soft startup via frequency controller).
4. The HP circuit shall be programmed such that the HP pump is first active in unpressurized circulation only via the actuated discharge valve or the machine bed flushing system.
5. With "HP active", the machining tool's pressureless circulation or machine bed flushing system is switched off.
6. During a workpiece change, the machine bed washer is reactivated or the system switched to the depressurized cycle.
7. If, after a defined time (parameterizable), no cooling lubricant is required, the HP pump is automatically switched off (machine in semiautomatic, setup mode, or no-parts mode).
8. The flushing pump (essentially only for grinding machines) starts up only when cooling lubricant is also required at the machining tool.
9. It is absolutely essential to ensure that the line to the HP pump cannot run empty (in particular after entering the "machine off" and "V5 closed" states).

1 6 7

9.2.3.2 High-Pressure Cooling Lubricant Monitoring

1. A pressure switch for pressure monitoring shall be installed downstream of the high-pressure pump (note pressure peaks).
2. At each unit with internal cooling lubricant supply, there shall be one valve controlling cooling lubricant supply to the spindles. This valve shall be monitored using a "valve open" position sensor. If the pump is delivering any pressure or the valve is closed, the machining movement of the unit shall be blocked (valves: The component parts can be found in the MFL (in BFS)).
3. Flow splitters are not permissible in the case of high-pressure cooling lubricant.

1 6 7

9.3 Isolating Valves

1. Automatic isolating valves (V5) at the interfaces of the main supply lines to the machine and rundown tank shall be designed in such a way that, in the event of a power failure (electrical, hydraulic, pneumatic), they move automatically to their cushioned, closed positions.
2. The option of throttling closing and opening movements is vitally required to avoid pressure surges and resonant vibrations.
3. The fittings for supply from the central cooling lubricant system shall be designed for a pressure of 16 bar.
4. Pilot control valves with detent for emergency manual actuation are not permissible.
5. Diaphragm valves, gate valves and friction valves may not be used.
6. Coaxial valves are only permissible up to NW65, and shall be used in conjunction with pneumatic or hydraulic pilot control.
7. Valves for grinding, lapping, stone finishing, etc. shall be equipped with a steel housing with carbide seat.
8. Isolating butterfly valves and ball cocks shall be provided with a pressure relief opening between the switching head and valve so that, in case of leakage, no cooling lubricant penetrates the compressed air system.

1 6 7

9.4 Blind Lines at Main Supply Pipes in the Systems

In the case of blind lines, the end flanges of the main line shall be provided with eccentric flushing connections at low points with a diameter of at least one third of the distribution manifold. At this location, a fixed drain with manual ball cock shall be installed in the chip conveyor.

1 6 7

9.5 Fine Filtering at the Machine

1. If, as part of high-pressure machining with internal lubricant supply, it is necessary to provide fine filtration of the cooling lubricant pre-filtered to 105 µm at the machine, a filtration process with which the required separation effect is achieved without disposable filter media such as e.g. paper felt shall be used.
2. For the feed to the tank, an automatic backwash filter is prescribed (the component parts can be found in the MFL (in BFS)).

a. Filter elements shall switch over automatically during operation, and therefore a multi-chamber configuration is required.
b. The filters may not run empty on switching off the cooling lubricant (gumming).
c. The shutoff valve shall be installed downstream of the filter.
d. Filter backwashing shall be possible with filtered substance and/or compressed air.
e. The sediment drain from the filter shall be routed into the overflow of the rundown tank.
f. Automatic cleaning of the filter shall be implemented by means of time and differential pressure.

3. A label stating the order designation of the filter insert shall be affixed to the system.

1 6 7

9.6 Unit with Own Supply

1. No residues which may pollute the environment must be produced, e.g. hazardous wastes, filtration medium and throwaway filters, etc.
2. The filtration concept shall be coordinated with the representative.
3. A link to the main machine shall be ensured for self-controlled coolant systems. and it shall be possible to switch it on and off from the main machine operating panel.
4. The following error messages shall appear in the main machine display:
   a. Missing substance (cooling lubricant): "min. level" = PRE-WARNING.
   b. "Pump dry run protection" = STOP AT END OF CYCLE (sufficient cooling lubricant shall still be available to complete the operating cycle).
   c. "Pressure or flow monitoring not OK" = EMERGENCY STOP.
   d. General malfunctions.
5. A fluid level indicator at the supply unit shall be guaranteed:
   a. Maximum filling level when machine not running
   b. Maximum filling level during automatic operation
   c. Minimum filling level.

1 6 7

9.7 Circulating Pumping Station for Cooling Lubricant

For requirements, see Chapter 2.8

1 6 7

10 Minimal Quantity Lubrication (MQL) for Metal-Cutting Machinery

General requirements pertaining to machines with MQL for single-spindle and multiple drilling heads.

1 6 7

10.1 General

1. The selection of the suppliers and the corresponding device technology depends on the complexity of the tools used and machining processes. Pre-selection takes place here via the BFS.
2. Only tooling suitable and designated for minimal quantity lubrication may be used.
3. Only MQL substances approved by the equipment manufacture and within Daimler AG may be used for minimal quantity lubrication. (DBL 6768)
4. The machining with MQL functions in a process-reliable manner starting at an air pressure of ≥ 5 bar. In order to ensure process reliability even when there is a pressure drop to as little as 4.5 bar (see Chapter Pneumatic System 5.1 General Information), the MQL process shall be ensured via a pressure increaser.

1 6 7

10.2 Machine

1. MQL shall be supplied exclusively through the working spindle.
2. The work room is fully encapsulated and equipped with air inflow ports suitable for the extraction volume for optimum extraction of dust and vapors as well as discharge of the emission constituents.
3. The machines shall be equipped with active or passive compensation to combat thermal displacement.
4. It is not permissible for machine lubricants to get into the working compartment.
5. The machine supplier shall ensure that the machine is not exposed to thermal strain due to chips and that the chips are discharged safely.

1 6 7

10.3 Clamping Device

1. The obligatory presence-of-workpiece sensor is designed with reinforced blowing air (improved cleaning effect).
2. For critical machining operations, reference points (hole, bushing or pin) shall be attached to the tensioning devices near the workpiece zero point for starting at cyclic intervals (e.g. thermal drift).

1 6 7

10.4 Slide Guideways

Lubrication for the sliding guideways shall be optimized, for example:

- Lubrication is enhanced
- Oil-air lubrication is employed
- Multiple scraper

1 6 7

10.5 MQL Technology

1. A shutoff valve for MQL lubrication shall be present directly upstream of the rotary feed-through (fast and reliable supply of the tools with MQL, reduction of the reaction time).
2. Avoid right-angle fittings (prevention of lubricant separation).
3. It shall be possible to control the MQL equipment by way of the machine control system or NC program, with various switching stages for air and lubricant, and this shall be capable of providing the required minimal quantity of cooling lubricant needed for the process.
4. Space shall be taken into account for the installation of a 1-channel and a 2-channel MQL device in the MQL machine, to enable subsequent replacement.
5. It is not permissible for air containing aerosols to be used for air blasting and cleaning.
6. An adequately constant compressed air supply shall be ensured.
7. Daimler AG guarantees a pneumatic system pressure (acc. to Chapter 5 "Pneumatic System"). A buffer tank for a pressure boosting device shall be provided for each MQL system. Service unit and piping cross-sections shall be dimensioned accordingly.
8. Throughout the MQL supply line, no increases in the piping bore are permissible, and if reductions of cross-section or bore are unavoidable, a taper with a cone angle of ≤ 60° shall be used at the transition zone.
9. All surfaces of the MQL infeed line which come into contact with the MQL substance shall exhibit a surface quality of Rz ≤ 6.3 µm.
10. The MQL substance in the unpressurized reservoir shall be at shop temperature (20–35°C, relatively constant due to the viscosity of the MQL oil) and shall not become additionally heated (e.g. through heat sources, solar radiation, etc.)
11. Minimum filling quantity sufficient for 600 hours.
12. The equipment and filling tank shall be readily accessible for maintenance.
13. To ensure the immediate MQL supply of the tool cutting edge(s), an automatic "filling cycle" is required for a new tool inserted in the tool magazine. This shall be ensured accordingly.
14. The MQL unit technology selection is made by an expert committee drawn from the technology factory, Planning, Production and Maintenance and is described in the workpiece-specific requirement specifications.

1 6 7

10.6 Interfaces

1. Interfaces shall be designed acc. to MBN 10386 – MBN 10388 (MBN = Mercedes-Benz standard).
2. The designations of the elements of a minimum quantity lubrication (MQL) system are shown in Figures 1 to 4.
3. The MQL system is broken down as follows:
    a. Device area: MQL device – rotary union
    b. Spindle area: Working spindle – tool adapter/coolant pipe
    c. Tool holder area: Coolant pipe – tool shank
    d. Tooling

1 6 7

10.7 Single-Channel MQL System

1. Schematic: Single-channel MQL system

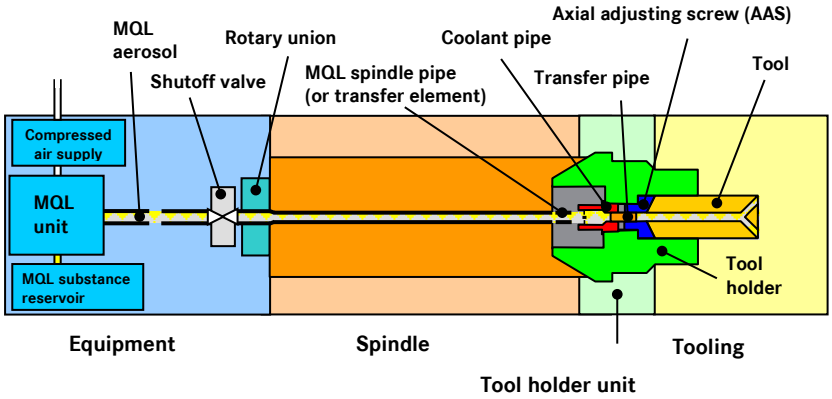

Fig. 1 Single-channel MQL system

2. The length of the infeed line from the MQL unit to the spindle may not exceed 3 m. This line may not contain any tight bends (bending radius ≥ 200 mm) or loops which form a siphon.
3. The capacity of the MQL unit shall be designed to match the expected demand.
4. Multi-spindle applications:
   - Any branches in the infeed line shall be implemented by drag-reducing distributors, e.g. Y-branches and not T-branches. The total distributed cross-sections may not exceed the infeed cross-section.
   - Distribution of the infeed line to each of the spindles at a unit shall be in a symmetrical arrangement.
5. Single-spindle applications: The minimum outlet diameter at the MQL unit shall be the same as that of the spindle bore and a maximum of 2 mm larger than this.
6. Only axial rotary feed throughs with an internal diameter corresponding to the spindle diameter as laid down in MBN 10386 shall be used (MBN = Mercedes-Benz standard). The following values shall be complied with for the compressed air supply (see Fig. 2):
   a. System pressure/primary pressure max. 5 bar (observe factory specifications, see also Chapter 5.1 Pneumatic System General Information)
   b. Aerosol pressure ≥ 2 bar
   c. volumetric flow rate ≥ 500 Nl/min

   With sophisticated machining operations (for example, gun drilling) significantly higher pressures shall be realized.

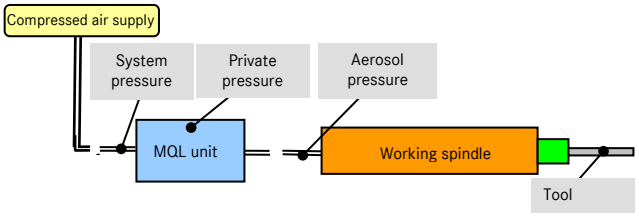

Fig. 2 Compressed air designations in the single-channel MQL system

7. The spindle shall be executed with a constant bore as laid down in MBN 10386 with no dead-flow areas. Should this not be possible, a continuous MQL spindle pipe with a constant bore as laid down in MBN 10386 shall be installed, connected tightly and leak-free to the rotary feed through.
8. An increase in cross-section at the transition from the rotary union to the spindle bore/ MQL spindle pipe is impermissible.
9. Should no MQL spindle pipe be available, a leak-free transfer element with no dead-flow areas shall be mounted from the spindle bore to the coolant pipe (tool).

1 6 7

10.8 Two-Channel MQL System

1. Schematic: 2-channel MQL system

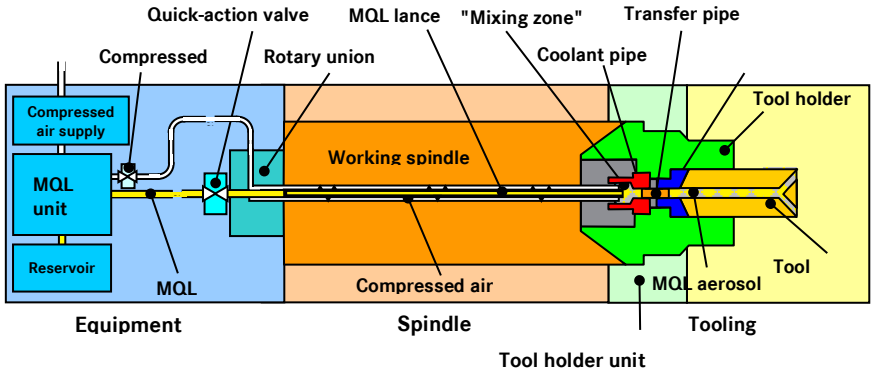

Fig. 3 Two-channel MQL system

2. With the two-channel MQL system, the MQL substance and the compressed air are directed to the rotary union in two separate lines. A quick-action valve (with a constant temperature of 50 ± 3°C) is installed in front of the rotary union for metering the MQL substance. From the rotary union, the MQL substance is routed via an MQL lance and the compressed air coaxially through the spindle bore into the mixing chamber. Within the mixing zone, the MQL aerosol is generated from MQL substance by the compressed air. The subsequent elements of the coolant pipe, transfer pipe and axial adjusting screw ensure leak-free transfer of the MQL aerosol into the tool.
3. The MQL unit shall be installed within the machine.
4. Two-channel rotary unions shall be used.
5. The following values shall be complied with for the compressed air supply (see Fig. 4)
    a. System pressure/primary pressure max. 5 bar (observe factory specifications, see also Chapter 5.1 Pneumatic System General Information)
    b. Aerosol pressure ≥ 2 bar
    c. volumetric flow rate ≥ 500 Nl/min
6. With sophisticated machining operations (for example, gun drilling) significantly higher pressures shall be realized.

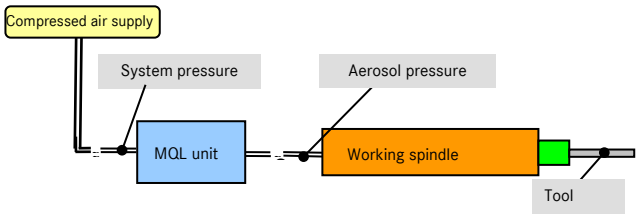

Fig. 4 Compressed air designations in the double-channel MQL system

7. The MQL substance and the compressed air are directed through the spindle separately in coaxial channels. For the MQL substance, an MQL lance shall be installed in the spindle from the rotary union. This shall project into the coolant pipe by a minimum of 2 mm and a maximum of 5 mm (see Figure 6).

1 6 7

10.9 Chip and Dust Removal

1. Because as little thermal energy as possible is to be dissipated to the workpiece and machine, measures shall be taken to avoid buildups of chips in voids in the workpiece and in the machine, if necessary by direct extraction to remove them.
2. There shall never be any accumulation of chips in particular at machine elements relevant to machine accuracy and machining results (e.g. in guide pieces, clamping device, etc.).
3. Free fall of the chips into the discharge conveyor with integrated dust extraction system.

4. Exhaust channels and chip conveyors shall be thermally insulated against the machine bed.

1 6 7

10.10 Work Room Extraction

1. The extraction strategy ("upward" and/or "downward through the chip conveyor") shall be coordinated on an application-specific basis with the representative responsible.
2. The extraction connection shall be provided with flow acquisition in combination with machine shutdown at the machine.
3. Loop seal formation is not permissible within the extraction area.
4. Peripheral exhaust filters are not permitted on the machine.

1 6 7

10.11 Tempering of Machine and Workpiece

1. Machine elements which are a heat source may have to be cooled down.
2. The planned temperature control of hydraulics, motor spindle, linear motors, etc. shall be to a uniform level.
3. If reliable adherence to the required tolerances is not possible due to temperature fluctuations at the workpiece (e.g. due to ambient temperature, heat entrainment through machining, etc.), corresponding countermeasures shall be taken, e.g. compensation for the deviations in the NC program or workpiece temperature control prior to machining. If tempering is necessary, it may only be active when required (workpiece temperature outside a specified temperature range).
4. If, due to the installation position of the electrical drives, it is likely the machine will warm up, they should also be cooled.
5. The hydraulic system shall be kept at machine temperature to prevent heat from entering the machine.

1 2 3 4 6 7 9

11Workpiece Handling and Linked Operation

1 4 6 7 9

11.1 General

1. For overhanging components in wet machining locations, drip trays or baffles shall be mounted to return any cooling lubricant which drips off them. At all linkage locations, a drip tray (see Appendix 03) shall be provided. If required, the cooling lubricant should be collected in an intermediate tank and returned to the machine by means of a return pump.
2. The drain is to be covered with perforated metal sheeting, with holes about 5 mm in diameter.
   Pipe connections of drip trays:
   a. in the mechanical manufacturing shop, piping shall be 1";
   b. At assembly and at inspection stations, piping shall be ½" (e.g. following an oil lubrication station).

1 2 3 6 7 9

3. In working compartments where the substance is water, the directly connected transportation components shall be corrosion resistant.

1 2 3 4 6 7 9

4. Transfer positions of linkages shall be settable using an index or fixed stop.
5. For indexing and positioning, hardened and ground indexing and fixing bushes as well as dowels shall be provided, and additionally corresponding clamping faces, which shall also be doweled.
6. The collecting pans should overlap at the joints of the individual machine linkages.
7. The erection elements shall be height adjustable.
8. Function assemblies, such as stoppers, rotating devices, clamping systems and lifting / lowering devices, shall be able to be viewed from the outside.

1 2 3 4 6 7 9

11.2 Incremental Stroke and Ram Conveying System

1. The end positions shall be adjustable and equipped with cushioning devices.
2. Only NC drives may be used for incremental stroke conveying systems at transfer lines.

1 2 3 4 6 7 9

11.3 Roller Conveyor (Chapter in MBN9666)

1. Roller belts are to be designed with sectional drives.
2. The section length shall be coordinated with the representative on a component-specific basis (e.g. by weight,

back pressure, component length).
3. Chain drive with durable, replaceable guides (automatic lubrication and tensioning of chains).
4. Drip trays (see Appendix 03) with extraction sump should be provided underneath all handling systems in wet-machining areas.

1 2 3 4 6 7 9

11.4 Chain Conveying System

1 2 3 4 6 7 9

11.4.1 Backup Roller Chain

1. Any jamming of the chain by small parts (screws, pins, valve keys, etc.) shall be prevented by means of fillers (cover clips) on the intermediate links (the component parts can be found in the MFL (in BFS)).
2. It shall be possible to exchange individual chain sections with a maximum length of 5 m.
3. A split link shall be located in the upper strand at all times.
4. Smooth, jolt-free running shall be ensured (so workpieces will not tip).
5. Chain lubrication depending on the application and in coordination with the representative.
6. The flange plates for drive, end sprockets and chain tensioners shall be manufactured from steel (not aluminum).
7. Non-driven sprockets shall be used at the chain ends, and not made up of crescent segments.
8. At the drive motor (gear motor), a dog clutch shall be provided so that the drive shaft can be disengaged from the drive motor.
9. The material used for the exchangeable runners shall be coordinated with the representative.

1 2 3 4 6 7 9

11.4.2 Plastic Chains (Chapter in MBN9666)

1 2 4 6 7 9

11.5 Rocker Conveying

1. Each individual rocker segment shall be easy to replace.
2. All contacts and wearing faces shall be readily exchangeable.

1 2 4 6 7

11.6 Belt Conveyors

Belt conveying systems shall be provided with tensioning options or bolts.

1 2 3 4 6 7 9

11.7 Workpiece Carrier Conveying

1. Severe contamination of the workpiece carrier by cooling lubricant, chips, dust formation, oil, etc., shall be ruled out by suitable measures.
2. If rubber buffers are used, the material applied shall be adapted to the fuels and lubricants used.

1 2 3 4 6 7 9

11.8 Tilting and Rotary Stations (Chapter in MBN9666)

1 2 3 4 6 7 9

11.9 Upper Transfer, Gantry Loader

1. It shall be possible to align the gantry frame via adjusting plates and adjusting screws.
2. Suitable measures shall be provided to prevent/eliminate any contamination of the roof pans by chips and cooling lubricant.
3. As a rule, roof hatches shall generally be in puncture-proof design.

1 2 4 6 7 9

11.10 Cable and Toothed Belt Lifts (Chapter in MBN9666)

1 2 4 6 7 9

11.11 Stations with Integrated Robot Systems

Chapter in MBN9666-2 or specific Requirement Specifications for robot applications.

1 2 4 6 7

11.12 Workpiece Magazine

1. The master compartment/reference compartment shall be labeled with MF in capital letters and blocked for normal operation.

2. Appropriate precautions shall be taken against fouling of finish machined parts.

1 2 4 6 7

11.13 Jaw and Rotation Units (Chapter in MBN9666)

1 2 4 6 7 9

11.14 Rotary Tables and Indexing Tables (Chapter in MBN9666)

All changes – type No., version, model, etc. – shall be marked on the data plate of the rotary table so that they can be easily read. Changes shall be indicated in the documentation (the component parts can be found in the MFL (in BFS)).

1 2 4 6 7 9

11.15 Stoppers (Chapter in MBN9666 + BFS component approval system)

1 6 7

12 Clamping Devices and Intermediate Stackers

The use of Gripp carbide inserts shall be decided on a case-by-case basis (e.g. obligatory for adjustment devices).

1 2 3 4 6 7

13 Marking Systems

1 2 3 4 6 7

13.1 Barrel-Type Embossing Dies

No barrel-type embossing dies may be used.

1 2 3 4 6 7

13.2 Print Wheel Embossing Dies (Chapter in MBN9666)

1 2 3 4 6 7

13.3 Needle Embossing Dies (Chapter in MBN9666)

1 2 3 4 6 7

13.4 Colored Markings

1. It shall be possible to adjust the rate of colored ink application.
2. Inkjet head and nozzle shall be easily accessible for cleaning and easy to replace.
3. The inkjet unit shall be provided with a positive positioning aid, for example a stop.
4. The colored ink reservoir shall be located outside the protection area of the machine and easily accessible for replenishment during operation, with ink supply hoses as short as possible and likewise easy to replace. They shall not be installed in energy management chains. The surrounding machine area shall be protected against spray mist.
5. A drip tray shall be installed beneath the spray nozzle.
6. The operating panel for complex labeling devices shall be mounted on the operator's side of the machine.
7. As far as possible, the inkjet device shall be self-cleaning so that even after lengthy shutdown periods, for example over weekends, no manual cleaning work will be necessary.

1 2 3 4 6 7

13.5 Laser Systems: see Powertrain Requirement Specifications, Part III – Electrical Components

1 2 3 4 6 7 9

14 Measurement, Inspection and Monitoring Installations

1 6 7

14.1 Mechanical Testing and Monitoring Equipment in Machining Units without Tool Monitoring

1. The following applies to machining units (e.g. transfer lines, rotary tables): All bores should be checked for tool breakage. As far as possible, the inspection equipment shall be configured in such a way that the same

inspection equipment can be used for "bores OK" and "threads OK".
2. The test shall be performed directly after machining.
3. The inspection equipment shall, if necessary, flush the bores to be inspected free of chips (flushing through the inspection probe when the process requires this). Blind holes shall always be flushed out.
4. An inspection probe plan stating lengths and diameters shall be created.
5. Inspection probes shall be easily removable and replaceable.
6. The inspection probes shall be designed in accordance with MBN 81036 (MBN = Mercedes-Benz standard; regulation also on Requirement Specifications CD).

1 2 3 6 7 9

14.2 Measuring Technology: Mechanical Design (see also MBN9666)

1 2 3 6 7

14.2.1 General

It shall be ensured that the sensor can be easily dismounted.

1 2 3 6 7

14.2.2 Force Measurement

1. To achieve optimum accuracy with the miniature compressive force sensor and miniature ring force sensor, the base of the sensor shall be mounted on a ground, lapped surface of adequate thickness, hardened throughout to 63 HRC.
2. For leads permanently attached to the sensor, during installation it shall be ensured that the cable exit is not subjected to impermissibly high tensile and bending forces.

1 2 3 6 7

14.2.3 Measurement of Displacement by Means of a Measuring Sensor (Chapter in MBN9666)

1 2 3 6 7

14.2.4 Torque Measurement

If mechanical screwdrivers are installed, torque measurement shall be implemented along with these.

1 2 3 6 7

14.3 Leaktightness Test Stands

The testing procedure to be used shall be decided upon in consultation with the representative responsible.

1 2 3 6 7

14.3.1 Equipment Configuration

1 2 3 6 7

14.3.1.1 Mechanical Components

1. The housing of the leak test unit shall be easy to open.
2. The housing of the leak test unit is to be designed with a standardized 8 m square lock. For this purpose, the front and rear shall be accessible.
3. The modules' energy and media connections shall be of the plug-in type and accessible (couplings).
4. The test unit number shall be attached on its front so it is clearly visible.
5. Designations of testing procedures shall be marked in plain language on the front.
6. An external leakage calibrator is needed for each project.

1 2 3 6 7

14.3.1.2 Electrical Components

1. Testing structures and formats shall be specified in detail.
2. A straightforward and logical file structure shall be prepared.
3. The test parameters shall be accessible without the need for any additional software.
4. The required parameters are to be provided in accordance with Powertrain Requirement Specifications Part V and MBN9666.
5. The required software of the leak test unit is to be provided in accordance with Powertrain Requirement Specifications Part III, Electrical Components.
6. Test units shall have a printer connection facility.
7. The interfaces at the leak test units are to be provided in accordance with Powertrain Requirement

Specifications Part III, Electrical Components.
8. Under the measurement program, it shall be possible to evaluate pressure increase and decrease procedures as well as the through-flow procedure for each measurement channel.
9. Appropriate password-protected operator interfaces shall be furnished for respective operator and setter groups. The passwords shall be documented and coordinated in accordance with Specifications Part III.
10. The measured value memory of the leaktightness test unit shall permit evaluation of the past month's readings.
11. It shall be possible to upload, save and archive operating parameters directly at the test unit.
12. Manual entry of parameters shall be possible at the test unit via a keyboard.
13. The measurement software shall be equipped with a diagnostic tool. This tool shall be capable of depicting evaluation of the filling, stabilization, measurement and air bleed curves, recorded as transient values over time.
14. Leaktightness test units shall be provided with software for optional selection or deselection of temperature compensation. The assembly and production outlay shall be coordinated with the representative.
15. The leak test device shall be equipped with a network connection with automatic data backup (the technical general IT conditions shall be complied with).
16. Leaktightness test units shall be provided with a self-testing function or alternatively a high-performance hardware diagnosis tool.

1 2 3 6 7

14.3.1.3 Pneumatics

1. The basic principles for pneumatic system design are set out in Requirement Specifications Part II, Mechanical Components, Chapter 5, and the MFL (in BFS).
2. A pressure gage for the test air shall be installed in an easily visible location at the front of the leaktightness test unit.
3. The pressure gages and their operating range (test pressure) shall be marked at the leaktightness test units.
4. A connection for a manual leakage calibrator shall be installed on the front of the leaktightness test unit. This connection is to be used in accordance with the BFS.
5. If the compressed-air quality specified in Chapter 28.1 is not sufficient, an oil separator shall be provided upstream.
6. Hose systems, valves and screwed connections of leak test units shall be used in accordance with the BFS.

1 2 3 6 7

14.3.2 Machine Tie-in

1. An overview of the configuration with workpiece shall be attached to the leak test unit, clearly showing the numbering of the supply units.
2. Decoupling:
    a. Thermal:

    The need for temperature compensation shall be coordinated with the representative.
    b. Hydraulic:

    During testing, hydraulic feed elements shall be decoupled from the remaining hydraulic system, so actuators will not move during testing.
3. The sealing elements required shall be resistant to the test fluid used. as the preferred material for this.

1 2 3 6 7

14.3.3 Pressure Test Basins

1. All components coming into contact with water shall be of stainless steel.
2. The basin's outlet shall be bigger than its inlet.
3. The bottom drain shall be located at the basin's deepest point.
4. The basin floor shall have an adequate slope to the bottom drain, so no deposits can build up and it can be easily cleaned from above.
5. The pressure test basin shall be provided with a peripheral overflow.
6. The sample should be pressurized before immersing it in the pressure test basin (avoidance of seeping water, at least 0.4 bar). The filling pressure shall be polled directly at the sample. The supply line shall be separate from the measuring line.
7. The lighting and the sight glass of the pressure test tank shall be coordinated according to the specific application.
8. Equipment according to the Water Resources Act (WHG) may have to be considered (floor pan, WHG indicator, overcharge protection, etc.) if additives detrimental to the water quality are used.

15 Electrical Screwdrivers (see also MBN9666)

1 2 3 6 7

For other stipulations see Chapter on "Measurements".

1. Screw-driving systems in a linked cycle shall be used only in consultation with and with the approval of the representative.
2. Wherever possible, workpieces shall be moved towards the screwdriver and not the other way round.

16 Slide Units and Drives (also in MBN9666)

1 2 3 4 6 7 9

1. A vernier or zero point identification shall be applied on NC axes.

16.1 Slide Guideways with Roller Bearing Guidance (also in MBN9666)

1. The following stop plugs in accordance with DIN ISO 12090-1/2 shall be used for fastening roller bearing guides:

Machining with abrasive substances:	Steel plugs
Machining:	Steel/bronze plugs
Assembly:	Steel/bronze/plastic plugs

2. The following applies to MO and the Gaggenau plant (030/034): A E F X
   Covering belts are approved on linear guides without chip incidence. This applies to machining tools on machining with a defined cutter and in assembly, coating, and dry testing systems.

17 Belt Drives (also in MBN9666)

1 2 3 4 6 7 9

17.1 Drive Belts (also in MBN9666)

1 2 3 4 6 7 9

Driving belts shall be replaceable without dismounting mechanical parts.

18 Drilling Head Swivel Units

1 6 7

BK swivel units are permitted only with the written approval of the representative.

19 Machining Spindles, Drive Units and Internal Coolant Supply

1 6 7

19.1 Spindle and Bearing Monitoring

1 6 7
A E F

1. Temperature monitoring: If it is decided following consultation with the representative that temperature monitoring is required, the sensors from the BFS shall be used.

Signal:	Function:
Alarm	Issue alarm at control panel
Shutdown	Issue fault message at control panel

2. Vibration monitoring: If it is decided following consultation with the representative that vibration monitoring is required, the sensors from the BFS shall be used.

19.2 Motor Spindles (also Chapter in MBN9666)

1 6 7

1.
2. The spindle nose installed dimension shall be blocked out against a reference surface.
3. In the case of multi-spindle machines, it shall be ensured that individual spindles can be exchanged without removing adjacent spindles, assemblies and media supply lines (including energy management chains).
4. Use of the spindles regarding manufacturer, type and version shall be coordinated with the representative

(the component parts can be found in the MFL (in BFS)).
The approval form for the use of motor spindles (template: Form 02 – Approval of Motor Spindles) as well as data sheets and drawings shall be submitted for approval. The signed approval form shall be integrated in the system documentation and shall be included with the component part approval on the BFS system.

The following applies to MO and Trucks: Coordination takes place with the representative.

20 Working Compartment Configuration, Machine Covers and Fire Protection

1 6 7 9

20.1 Extraction at Machining Tools

For requirements, see MBN9666-2

1 6 7 9

20.2 Machine Extraction Monitoring Unit

For requirements, see MBN9666-2

1 3 6 7 9

20.3 Fire or Explosion Hazard and Fire Protection Facilities on Machines (Chapter in MBN9666)

As part of the risk assessment according to Machinery Directive 2006/42/EC, the manufacturer shall in particular also evaluate the **Risk of Fire and Explosion** (see Appendix 1 nos. 1.5.6 + 1.5.7). To avoid/minimize risk, DIN EN 12100 "Risk assessment and risk reduction" shall be applied as shall DIN EN 13478 for fire protection. For the selection of suitable fire protection equipment in accordance with DIN EN 13478 No. 7.3, the representative shall be included in the assessment of property or environmental damage.

The risk assessment shall form an integral part of the bid and a basis for defining the measures to be implemented at the machine.

Should the result of the risk assessment be that fire protection equipment is required, the following provisions shall apply:

The fire protection equipment is procured by Daimler's department. The corresponding interfaces and specifications are to be observed in accordance with Powertrain Requirement Specifications Part III "Electrical Components, Control Technology and Production-Oriented IT Systems", Chapter 4.9 "Machine and System Fire Protection".

1 3 6 7 9

20.4 Opening the Guard Door During Fires

1. Since locked guard doors are a hindrance to firefighting teams, their design shall take the following into account:
    a. Door lock switches shall be applied in an easily accessible position outside the cover.
    b. It shall be possible for the plant fire service to open the machine door without having to apply energy.

20.5 Accessibility of Machines for Repair Work

Valves, pressure switches, controllers, etc. for hydraulic and pneumatic systems, shall be mounted in such a way that these can be operated outside of the machine or protection zone. Wherever possible, there shall be a clear view into the machine to observe movements and operations.

21 Erection of Machines and Equipment

1 2 3 4 6 7

21.1 Erection

1 2 3 4 6 7

21.2 Floor Pans for Machine Tools

1 6 7 8

Valid for Plants 30/34 Gaggenau and for Plant 69 Kassel: X Y

1. A floor pan is required for every machine tool (wet machining only).
2. The floor pan does not belong to the machine supplier's scope of delivery.
3. Floor pan drawings are to be made available by the supplier.
4. The edge height is based on the amount of fluid to be collected (design in accordance with the Water Resources Act (WHG))) and shall be coordinated with the representative.
5. The machine supplier shall create a pan plan according to the statutory bases with a minimum height of 50 mm. The ground clearance of the ancillary assemblies, chip conveyors, erection elements, etc. requires urgent consideration as regards the displacement volume in this case.
   The machine zero point shall be drawn and completely dimensioned in the pan plan (see Appendix 05.3).

Valid for Plant 20 Mannheim: Z

1. No floor pan is required for machine tools.
2. The machines are installed with a ground clearance (distance between the tray and the floor of at least 120 mm; otherwise see AwSV) to ensure that the areas below them can be inspected and cleaned

Valid for MO: No floor pans shall be planned under machine tools. A E F

21.3 Erection Elements

1 2 3 4 6 7

22Component Feeders

1 2 6 7

22.1 Separators and Automatic Sorting Devices

1 2 6 7

A screw separator shall be installed ahead of the screw transfer point. Only rake-type separators (rams) shall be used for screws. Rotary separators are not permissible.

22.2 Vacuum Assembly Process

1 2 6 7

1. If vacuum pumps are used, these shall be dry-running pumps. The component parts can be found in the MFL (in BFS).
2. Vacuum generators, extraction tools, hoses and switches shall be designed for easy replacement.

23Test Stands

3 6 7

23.1 Basic Configuration

3 6 7

1. In the event of a sudden pressure drop in pneumatic or hydraulic systems, or a failure in the electricity supply, the positions of the test stand and workpiece – the sample – shall be reliably retained.
2. The test stand bed shall be fitted with a vibration absorption arrangement that corresponds to the sample. (Vibration elements, vibration foundation)
3. Test stands and test stand components shall be corrosion-resistant as well as resistant to oil, fuel, and corrosion inhibitors.
4. If rubber buffers are used, the representative shall be consulted.
5. Test bench floors and steps shall be provided with non-slip surfaces, and be resistant to oil and fuel.

Steel plates shall be hot-dip galvanized.
6. Double floor coverings shall be provided with openings to facilitate removal of the cover plate.
7. For engine test stands only, the samples shall be accessible from at least two sides.
8. The test stand bed shall be in the form of a pan with inclined run-off surfaces and defined drainage points. Sumps shall be of stainless steel.
9. For test stands with raised platform flooring, a monitored sump pump shall be installed for leakage control.
10. Where test stands are free standing, they shall be accessible to hoisting gear at all sides.
11. Heavy components shall be provided with sling-attachment eyes.
12. Soundproof cubicles supplied by the system manufacturer shall be equipped with maintenance and repair aids for removing test stand components (rail with overhead trolley for lifting equipment, etc.)
13. Protective cladding shall be designed so that it can be easily removed and installed by one person. The minimum possible number of detachable fasteners shall be used, and these may possibly be in two parts. The elements shall be provided with grips and rapid screw-attachment devices.
14. There shall be no components mounted on the removable elements of the covers.
15. To enable the functional compartments to be viewed, inspection windows shall be integrated into the testing machine's protective cladding.
16. All parts coming into contact with the sample or workpiece carrier shall be resistant to wear, e.g. made of hardened and ground steel.
17. Wearing parts shall be designed for ease of exchange and, wherever possible, standard parts shall be used.
18. Calibration instructions gage capability certificates, calibration aids (such as levers, weights, etc.) shall also be supplied.
19. A sufficient number of all required adapters (to be defined in the project) shall be provided by the supplier as initial equipment. A parts list with drawing and order number for all adapters shall be prepared and supplied.
20. If areas for mounting and removing equipment are needed for testing, these shall be configured in compliance with the same design criteria as the test stand.
21. At transmission test stands, hydraulic units shall be operated with the same oil as the test oil used in the transmissions.
    For Plant 034 "Gaggenau": consultation with the representative | X
22. -

23. The test programs shall be flexible with respect to model type, number of types and modifications to the samples. Parameterization by the operator shall be possible.
24. The option of test chamber extraction shall be provided.
25. The design shall allow easy and rapid alignment of sample and test stand components, e.g. by providing guidance grooves in the baseplate.
26. The pumps at the hydraulic unit shall be specified with a 30% capacity reserve.
27. Shaft connections should be designed only with clamping elements (no feather keys).
28. Profile rail rolling bearing guideways to DIN 645 Parts 1 + 2 shall be used: round bar guideways are not permitted.

3	6 7

23.2 Feed

1. Test stands shall be provided with guides for traversing in the palette or trolley.
2. Stoppers shall be equipped with a cushioning head.
3. For positioning and indexing, hardened and ground indexing and locating bushes and dowels shall be provided, in addition to corresponding clamping surfaces (pinned).

3	6 7

23.3 Substance Supply and Removal at Test Stand

1. Substance lines to building service systems shall be located on the outside walls of test cells, and shall each be equipped with an automatic shutoff device. For the event of a power failure, it shall have a fail-safe design, i.e. so that it shuts off. A drip tray shall be provided at the central transfer point.
2. Manual shutoff cocks shall be mounted upstream of each automatic shutoff device.
3. At an easily accessible location in each media circuit, measuring connections for e.g. temperature, pressure and flow as well as setpoint input must be provided.
4. Piping for fuel and test oil shall be of stainless steel (see "Hydraulics" section).
5. Piping for cooling water shall be of stainless steel or PVDF.
6. At oil and water circuits, oblique valves shall be used.
7. Change-over filters with contamination indicators are to be used at centrally supplied oil and water inlet lines.

(Design of the soiling indication according to MBN-9666-5)
8. Pumps in the engine cooling water circuit shall be resistant to high temperatures (at least 100°C) and resistant to corrosion protection agent, i.e. they shall be made of metal.
9. Coupling plates shall be designed in such a way that individual elements can be easily replaced if they are defective.
10. Fastenings for the required media supply valves shall be of quick-change type at easily accessible positions on assembly plates.
11. Pipes shall be provided with couplings/threaded connections for rapid removal and reinstallation. Consultation with the representative.
12. Circulating pump stations shall be separately actuated and shall remain active even when the test stand is switched off.

3 6 7

23.4 Substance Supply and Removal – Sample

1. Docking systems (multiple couplings) shall be designed drip-free and made of stainless steel (engine test stands only).
2. Multiple couplings shall be engaged by advance centering mandrels (engine test stands only).
3. Coupling plates shall be designed in such a way that individual elements can be easily replaced if they are defective.
4. Electric couplings shall be provided with intermediate pin-connectors (engine test stands only).
5. Multiple couplings shall be equipped with a powered engaging and disengaging system (engine test stands only).
6. For checking the setup, media lines shall be automatically pressure tested before starting the testing sequence (engine test stands only).
7. Fastenings for the required substance supply valves shall be of the quick-change type at easily accessible points on assembly plates.
8. If possible, substance adapters shall be designed for the test object with quick-acting connectors and on the test rig (pallet, trolley) with quick-release couplings. The pallets/trolleys shall be designed in such a way so that any leakage can be collected and discharged purposefully during machine setup/removal.
9. All substances required for test runs shall be drained sufficiently so that they will not spill out during subsequent assembly operations.

3 6 7

23.5 Drive Unit/Brake

1. The drive concept shall always be coordinated with the representative.
2. The drive train shall be equipped with a sliding or hinged shaft protector with polling.
3. The drive unit, including drive train, shall be accessible from at least two sides.
4. If drive power is transmitted via a belt drive, a tensioning device shall be provided. A label containing the following information shall be permanently affixed: Belt type, belt length (poss. depiction of the belt's routing), belt tensioning regulations. The belt tension shall be specified in Hertz.
5. One belt tensioning test unit shall be supplied per project.
6. If eddy current dynamometers are used, a primary/secondary coolant circuit shall be provided.
7. Evidence shall be provided of the operational safety of the drive train by a vibration analysis.
8. It shall be possible to cool the drive train, by air or water, at its bearing points. Measuring points for temperature monitoring shall be provided (only engine test rigs).

1 2 6 7

24 Coating Stations

The following applies to coating equipment directly assigned to a production or assembly line.

1 2 6 7

24.1 General

1. The axis drive units shall be designed for a 100% duty cycle.
2. Servo motors, and not stepping motors, shall be used for axis drives.
3. The component to be coated shall be positively located.
4. Substance hoses and valves shall be readily exchangeable.
5. In its home position, the coating unit shall be positioned over a drip tray.
6. Both the component holder and the coating system shall be easy to clean.

7. The filling level of the storage receptacle shall be monitored.
8. The nozzle shall be designed with a predetermined breaking point.
9. Metering systems (helical spindle pump, metering head) shall be presented to the representative for approval.

1 2 6 7

24.2 Anaerobic and Low-Viscosity Sealants

1. A device for detecting flow shall be provided without fail, to register air bubbles.
2. The use of flow monitors shall be coordinated with the representative. A switching element deflected by substance flow is not permissible.
3. Wherever possible, transparent hoses shall be used.
4. The reservoir shall be arranged for easy access and fitted with a removable cover for cleaning. Operating pressures shall be displayed by pressure gages.

1 2 6 7

24.3 Silicone

1. If silicone is applied, the medium shall be supplied by means of a twin cylinder reservoir and shall be metered via a helical spindle pump (no heater coils) See schematic in Appendix 15.
2. Setting of the silicone during lengthy stoppages, for example during malfunctions or at weekends, etc., shall be prevented by blanking off and/or immersion in a sealing fluid.
3. For silicone coating, an outlet valve shall be provided directly upstream of the nozzle in the coating system.
4. The metering pressure (system pressure) is measured and controlled with a digital pressure sensor. The pressure sensor is to be applied as close as possible to the metering system.
5. At coating stations with two or more metering systems, separate silicone supplies for each shall be ensured by twin cylinder.
6. Plunger pumps shall be presented to the representative for approval.
7. The inclusion of ventilation points shall be coordinated with the representative.
8. For fixed coating application systems (-> component is moved) the application position may not change when components are replaced.
9. Ball cocks shall be installed upstream and downstream of the metering pump.
10. Hoses and pipelines shall be kept as short as possible, with the length from metering pump to outlet valve not exceeding 6 m.
11. Servo motors shall be used for driving the metering pumps, and not stepping motors.
12. A pressure relief valve shall be installed immediately downstream of the screw pump (e.g. rupture disk -> electrically monitored).
13. ½" and ¾" ball valves with Teflon seal are to be used as shutoff devices at silicone application pumps.
14. Refer to Power Requirement Specifications Part III - Electrical Components for regulations and approvals for the coating station.

1 5 6 7 9

25Cleaning System (Washing Machines)

The employed technology appears in Appendix 12.4 – Cleaning System Function Diagram

1 5 6 7 9

25.1 State of the Art and Connections to Component Cleanliness

1. Component cleanliness has become a quality characteristic since the introduction of reproducible analysis methods and standardized limit value nomenclature. The standardization documents of ISO 16232 and VDA 19 on particulate component cleanliness have been introduced consistently by the industry. The Daimler supplier specifications VDA Volume 19 and 6516 represent a summary of these standards and are regarded as reference documents for suppliers.
2. DBL 6516 versions __.10, __.20, __.30, __.40 and __.50 are currently used in practice for the definition of residual dirt limits.
3. When the residual dirt limit is assigned, the component is assigned one of the aforementioned versions. If the component has several sensitivity ranges (e.g. hydraulic oil, depressurized oil, and water space), the version classification is determined by the most sensitive area.
4. The lower the version (e.g. .10), the more sensitive to dirt the component is and the higher the technological applications are in order to establish this cleanliness and maintain it up to the installation.
5. The versions are assigned degrees of purity.

Assignment of DBL 6516 versions to degrees of purity:

Residual dirt limit Version		Largest perm. particles [µm]	Degree of purity
Extremely functionally critical	.10	X ≤ 200	Finest level of purity
Considerably functionally critical	.20	200 ≤ X < 600	Fine level of purity
Functionally critical	.30	600 ≤ X < 1000	Normal purity
Less functionally critical	.40	1000 ≤ X < 2000	Rough purity
Undefined particulate	.50	-	Undefined particulate purity

6. Degrees of purity are required for the categorization of production equipment and environments.
7. The degree of purity represents the sensitivity of the cleaning process and has direct consequences on the machine design.
8. If a component has been classified in version .50 (residual dirt limit particulate undefined), the requirements for the cleaning results (e.g. degreasing degree, etc.) are to be described in the workpiece-specific requirement specifications.
9. The requirements of the intermediate cleaning process for the production, for example of .10 components, cannot be derived from the final component residual dirt limit. Depending on the task description, the required degree of purity (e.g. .10 to .50) shall be defined in the workpiece-specific requirement specifications. Intermediate cleaning systems usually do not have to create the same high degrees of purity of final cleaning systems.
10. High component quality (fine and finest purity) can usually only be achieved by several cleaning processes (dirt dilution effect).

1 5 6 7 9

25.2 Legal Requirements and Laws

These particularly include:

a. German Water Resources Policy Act (WHG)
b. Ordinance on Installations for the Handling of Substances Hazardous to Water (AwSV)
c. Federal Immission Control Act
d. Cleaning system shall be designed in accordance with DIN EN 12921-1 to DIN EN 12921-4

The following should be additionally observed/complied with when using cleaning agents containing solvents:

e. Specifications of the ordinance on solvents (31. BImSchV).

1 5 6 7 9

25.3 Safety Requirements for Washing Machines

1. It is not permissible to install substance storage tanks above the level of the process room.
2. Exception: For deluge washing, only the substance volume (required for the next process cycle) may be stored above process room level; this volume shall also be accepted by the tanks on the lower level for repairs and maintenance. This should be duly considered also for the tank level controls.
3. It shall be possible to open entrances to the process chamber (safety door switch with locking mechanism) only after the tank above it is completely empty (by automated draining if "stop at end of cycle" is selected; by specific selection of the draining process before opening the access doors in the case of EMERGENCY STOP).
4. The load voltage of the filling pump shall have been switched off.
5. It is not permitted for dangerous movements to be initiated by the pneumatic and hydraulic systems, e.g. valve actuation or flap controls, mechanical movements.
6. If process chambers have to be entered for maintenance or repairs, there shall be no cleaning agent either above or immediately below the process chamber. Steps shall be taken to exclude any danger to personnel arising from the substance.
7. The above process shall be visualized at the access doors via danger notices.
8. No dangerous movements shall take place in the event of EMERGENCY STOP or a power failure.
9. For safety reasons, design measures shall be taken for access to the system for maintenance during the bidding and planning phases and implemented by the time of commissioning (see DIN EN ISO 12100).

1 5 6 7 9

25.4 Materials

1. When using watery substances, all system parts subjected to the substance (system housing, fittings, bath tanks, floor pans, filter housings, pipes, slides, nozzles, valves and check valves, dry, blowing and washing zones, reservoirs, etc.) shall be made of stainless steel (min. V2A – 1.4301). When using chemicals (acids,

alkaline solutions, etc.), the material should be designed accordingly.
2. It is essential that deviations from the stainless steel version (e.g. when oil or cooling lubricant is used for cleaning purposes) be coordinated with the representative.
3.
4. Components which come into contact with DI water are to be made of resistant materials according to DIN6601 (substance compatibility list).
5. It is not permitted to use rolled plain bearing bushes (DU) or spherical bushings. The use of plastic bushings shall be coordinated with the representative.
6. Since various cleaning agents from different manufacturers are used at Daimler, the hoses, seals, rubber buffers, etc. used are to be of appropriately resistant materials. Hose lines conducting washer fluid are to be selected in accordance with the BFS.
7. Indices, index bushings, clamping pads, clamping claws, clamping fixtures (e.g. in bogies or cell wheels), end rails of clamping beams, actuation rollers, wedges, etc. are to be of hardened design.
8. The running surfaces of pallet and workpiece carriers are to be made of hardened strips which can be quickly replaced.
9. Heating elements which come into contact with substances in the washing agent containers are to be made of stainless steel 1.4571 (V4A).
10. Only bolts, nuts, dowels and washers of stainless steel may be used in the wet area of the HP system. The use of an appropriate means of separation is obligatory.

25.5 Substance Care of Cleaning Systems

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1	5	6 7	9

25.5.1 Bath Cleaning and Care

1. The conditions for the disposal of substances by means of central systems or waste water treatment systems depend on the respective local infrastructures and shall be coordinated with the representative in consultation with the respective departments.
2. Bath care is necessary whenever this is required to achieve the cleaning quality and the scheduled maintenance intervals for the disposal of the substance are too long.
   Bath care shall also be planned so that, when the system is switched off (control system off) or during long down times, the washing substance is regularly circulated in the system to prevent bacterial growth or "fouling" of the substance (additional pump(s); poss. in combination with washing substance heating).
3. Oil removal from the washer fluid for self-supplied systems shall be coordinated with the representative (extension of service lives, waste water reduction).
4. Oil removal from washer fluid and care shall also be able to be carried out in all tanks and tank zones even after the end of work. The oil separator shall be provided with programmable run-on. The stoptime shall be coordinated with the representative.
5. The oil separator is to be designed with a reserve of 30% and installed in the bypass.
6. Evaporator systems shall be used only following a thorough inspection; it is essential that their use is coordinated with the representative.
7. The collecting tank of the oil separator is to be equipped with level monitoring. Pre-warning at 80% fill level. The machine shuts down at 100%

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25.5.2 Chip Disposal and Foreign Body Retention

1. The chip disposal concept shall be adapted on a location-specific basis and shall be coordinated with the representative.
2. The tank and the machine housing are to be designed for the optimum discharge of substances and chips (low-maintenance machine; e.g. tank bases with slope).
3. The machines are to be equipped with a return pump for washer fluid and chip removal if necessary. In order to pump the washer fluid and chips to the central unit or for water treatment on site.
4. The return pump shall be protected against damage by foreign matter.
5. If strainer baskets are used, they shall be able to be handled ergonomically by an employee (basket weight). The permissible mesh size of strainer baskets is determined by the pump used.

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1		5	6	7 9

25.6 Design of Washing Machines

25.6.1 General Details on Washing Machines

1. All discharge of substances shall be avoided (water discharge in the pump house, process zones and transfer lines, substances discharge with workpieces, mist and vapors. Generation of excess pressure in the cleaning/drying zone shall be avoided (risk of vapor/mist discharge). Leak lines from pumps, etc. shall be routed to transparent receptacles that can be drained.
2. Ball-and-socket joint casings shall be of steel. These joints shall be connected to the central lubrication system.
3. All labeling on the systems shall be applied permanently and correspond to the documentation and flow charts. The attachment of the labels shall be coordinated with the representative.
4. Plain text labeling (e.g.):
    a. Pressures (pressure ranges), temperatures, flow rates, concentrations, etc. with tolerance specification (red – impermissible area; green – nominal area) at pressure gages and measuring points.
    b. Temperatures at thermometers
    c. Parameter lists for pressure switches and temperature monitors
    d. Belt and chain designations with order details
    e. For belts, statement of belt tension in Hz
    f. Unassignable shutoff elements
    g. Each end of disconnectable lines where there is a danger of mixup
    h. Valve designations according to plan with function in plain text
    i. Danger labels and servicing instructions
    j. Lubrication schematics, etc.
    k. The following applies to Trucks: All substance lines at interfaces to Daimler's scope of delivery shall be labeled with medium and direction of flow.
5. Maximum drive torque shall be matched to the driven mechanism, particularly when the transmission uses gears. For the drive types and driving powers, it shall be ensured that no consequential damage is caused by the driving power in the event of a crash or failure.
6. Due to high availability, all systems are to be subjected to examination mainly with regard to "low wear" and "ease of repair".
7. Drive motors shall be mounted where they are easily accessible.
8. It is not permitted to use silicone, adhesives or similar substances to seal the systems.
9. Provide chain and belt drives with a sufficient re-tensioning range (at least two chain links).
10. It is not permissible to modify standard parts.
11. It is only permissible to attach parts to plates and sections using stable connection elements (depth of thread at least 1.5 x diameter).
12. Driven components, like pumps, shall be matched to the drives' standard flanges and standard shaft diameters.
13. Pumps and their drive motors shall be mounted without assembly stresses.
14. All drive components installed in particularly unfavorable environments shall be protected in such a way by easily removable guards against fouling by chips, liquids, etc. that low-maintenance operation is ensured.
15. The installations shall be made accessible to allow servicing and repair without the need for major disassembly (applies for all components, to attain high availability of the installations).
16. The space required for removing components shall be indicated in the installation plan.
17. Measures are to be taken to ensure that the same positions are kept during dismounting and mounting (clamp connection is insufficient but can be used in combination with a feather key as locating aid). Examples: Attachment of levers on shafts (e.g. for lifting arms, bulkheads, nozzle boxes, etc.).
18. Multi-track machines shall be designed control and program specifically in such a way to allow them to be selected and deselected independently in the event of malfunctions and repairs.
19. Wearing parts shall always be easily exchangeable.
20. Only through-bolts shall be used.
21. No circlips or lock washers shall be used for the fixation of elements and assemblies.
22. Pin connections: heavy-duty rollpins, straight pins or tapered pins only with through holes. Cylinders and tapered pins only with the maximum possible diameter and withdrawing thread.
23. To avoid clamping errors, it is necessary to check the workpiece contours at the machine inlet

(mechanically/electrically).
24. Spring-loaded jigs and fixtures: provisions shall be made to prevent the workpiece from falling out if the spring breaks.
25. The feed pipes should be able to be separated at partition walls (flange connection/bulkhead connection). Pipes are to be provided with couplings/threaded connections for rapid removal and installation.
26. Aids for maintenance work are to be provided for removal and installation work inside and outside the washing machine (nozzle boxes, transmissions, motors, pumps, large flaps, etc.).
27. Feed, drain and overflow lines shall be able to be closed for maintenance measures.
28. Diaphragm valves and wedge-type gate valves shall not be used.
29. Hoses required for washing and cooling water are to be designed with swaged fittings.
30. Vertical supply pipes shall be intercepted/supported at the machine.
31. Hydraulically operated movements shall be adjustable (according to the pressure and volume) and equipped with a measuring connection.
32. Drives shall not be installed in the wet area. Exceptions are to be coordinated.
33. In the event of long transfer bar and comb conveying system lengths, the individual sections are to be selected so that they are easy to remove (handling during removal). Sufficient space for this shall be provided at the machine location, and shall be shown in the erection drawing. Actuating rod and conveying beam disconnection locations as well as bearings shall be readily accessible.
34. The openings for the component inlet/outlet and between the process zones are to be reduced to a minimum and provided with profile gages. The use of clock-controlled bulkheads shall be examined as an alternative. No contact with the component is permitted.
35. As a general rule, cleaned components shall not become soiled again due to contact with system components.

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25.6.2 Marking of Axes

1. Marking of axes shall be done in accordance with Requirement Specifications III – Electrical Components.
2. If NC/servo axes are used on a cleaning system, zero point marking and graduation / block dimensions shall be attached durably to the unit in an easily visible location (plate with measuring locations and dimensional data).

1 5 6 7 9

25.6.3 Work Chamber Cleaning

1. During spray cleaning and HP deburring procedures, dirt particles are thrown from the workpiece onto the walls and ceiling of the spray booth where they may remain. Workpieces may be re-soiled by falling or back-purged particles. The work chamber is to be automatically cleaned according to the cleaning requirements.
2. It is imperative to use zone cleaning nozzles in the relevant process zones in order to meet the residual dirt requirement DBL6516.10 and recommended in order to meet the requirements according to DBL6516.20.
3. The nozzles shall be supplied with a filtrated substance from the respective cleaning zones.
4. The purging process is to be selected variably with the equipment control in terms of the starting time and the duration.
5. The zone cleaning concept (type and purging interval) shall be coordinated with the representative.

1 5 6 7 9

25.6.4 Fittings (e.g. Lock-up Valves, Ball Valves, and Valves)

1. Pressure losses in pipes between the pump and the cleaning tool shall not exceed 10%. Proof of this shall be provided on request. An option of monitoring the substance pressure shall be provided directly in front of the cleaning tool. Valves installed in pipelines shall have the same cross section as the pipeline (ball valves have the full opening area). Reductions and pipe bends are to be kept to a minimum.
2. All valves are to be substance-resistant, preferably in stainless steel (see Chapter "Materials"). The substance resistance may be achieved by a coating.
3. Shutoff elements shall be designed with metallic sealing.
4. Only freshwater valves which meet the specifications of the DVGW (German association of the gas and water industries) shall be used.
5. Isolating butterfly valves and shutoff valves at the interface between the main supply line (central washing water supply) and the machine or holding tank shall close automatically to a cushioned end position in the event of failure of the electrical, hydraulic or pneumatic power supply.
6. Isolating butterfly valves and ball cocks shall be provided with a pressure relief port between switching head and closing element. Should seals be damaged, no fluid shall seep into the pneumatic systems.

7. A possibility for throttling flow during closing and opening, to suppress pressure surges and resonant vibrations, must be provided.
8. Manual shutoff and control devices for fluid flows shall be color-coded at their operating grips depending on function, using a heat-shrinkable pipe:
   Red: Closed in automatic mode
   Green: Open in automatic mode
   Yellow: Manual process quantity control
9. It is not permissible to use diaphragm valves, wedge gate valves and friction valves.
10. The flaps, y-valves and coaxial valves for the supply from the central substance system shall be designed for an operating pressure of 16 bar.
11. No water valves controlled with their own substance may be used.
12. When using butterfly valves in areas where absolute leaktightness is not a requirement, annular gap or metallic sealing valve trim shall be used.
13. A lockable, easily accessible manual isolating valve shall be installed in the intake line to the main automatic shutoff valve (BGR117). This also applies to return pumps, with lockable, easily accessible manual isolating valves downstream of automatic ball cocks.
14.
15. The position is to be monitored electrically at system-critical shut-off elements.
16. Only metallic sealing shut-off elements may be used upstream of the last filter stage.

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25.6.5 Bath Level Control

1. Level controls shall not be equipped with float switches (e.g. mercury switches, etc.).
2. Guided stainless steel floats with externally applied adjustable actuators or pressure transducers (LISA) are to be used. Only pressure sensors (LISA) shall be used in the supply for washing machines with 100% washer fluid exchange (also see Appendix)
3. The level control is to be equipped with the following functions: "dry run protection", "min" and "max".
4. A further safety switch shall be mounted above the maximum level switch, for overflow protection. When this is triggered, substances inflow shall be shut off immediately and any installed protection devices shall be activated (e.g. return pump).
5. The overfill protection and return pump shall also be active when the machine is shut down (see Chapter 2.8 Circulating Pumping Stations).
6. The float shall be protected against contamination and substance turbulence, and accommodated in a calmed flow zone.

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25.6.6 Tank Design

1. All tank, process and intermediate zones carrying substances, including their installations, are to be designed in such a manner that they are emptied without residue in less than 15 minutes after opening the drain valve.
2. Chips may remain in chip collection zones only if this is required by the client.
3. Spray water zones and immersion flooding washing zones in final cleaning systems should be emptied without residue after each working cycle. Jigs and fixtures should be provided for self-cleaning if no other solution is possible.
4. Provide good cleaning options (maintenance case), no dead zones. The entire tank floor shall be within view and accessible for spraying. The tanks are to be provided with a slope towards the drain hole. A connection for pumping out the cleaning agent manually is to be provided at the deepest point of the tank.
5. Tank caps are to be designed with handles and shall not be screwed. The size and weight of the caps shall be selected in such a manner to allow an employee to handle them ergonomically.
   It shall be possible for one person to open caps attached by hinges, and the caps shall be secured against inadvertent falling closed.
6. To prevent steam from escaping, a circulation edge filled with water and/or dog-type latches should be implemented at the tanks provided with caps.
7. If large fluctuations in pressure are expected in the tank (e.g. in the event of high volumetric flow rates), the tank caps are to be closed tightly with quick-clamping devices.
8.
9. The tank and drainage lines shall always be made with a downward slope of ≥ 1% to the outlet.

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25.6.7 Floor Pan

1. It is imperative to ensure that different substances cannot be mixed as a result of leaks and overflows by the cleaning system (e.g. cooling lubricant and washer fluid).
2. As a rule, washer systems should be placed in a floor pan. The floor pan is included in the scope of delivery of the system.
3. The retention volume of the floor pan depends on the Ordinance on Installations for the Handling of Substances Hazardous to Water (AwSV) in the individual federal states.
4. In all cases at least the volume of the largest spillable tank is to be collected.
5. The calculation is to be stored in the documentation.
6. The floor pan is to be made of stainless steel (min. sheet thickness of 2 mm, see Chapter "Materials" for the material). When using chemicals (acids, alkaline solutions, etc.), the material of the floor pan should be designed accordingly.
7. Electrical devices (e.g. on pumps and valves) shall be installed above the maximum possible fluid level of the collecting tray.
8. No fluids shall be discharged into the floor pan as a result of processes (e.g. when the filter housing is emptied).
9. The floor pan shall be monitored with a leak warning detector. The leak warning detector should have test approval according to Sec. 19 of the Water Resources Act (WHG), see also MBN 9666 Chapter 3/ Approval of procurement source.
10. The following measures shall be fulfilled if the leak warning detector responds:
    - The entire system (apart from the safety devices) shall be shut down immediately.
    - The filling and replenishment devices is to be closed immediately.
    - The machine should be prevented from overflowing in the shop, for example by switching on the return pump
      (see also Chapter 25.9.1). The link between the level monitoring of the collection tank, which may have been provided by the customer, and the washer system return pump shall be checked and coordinated with the representative.
11. A visual and acoustic alarm is to be issued and the corresponding fault message displayed on the control panel. An alarm interface to a central annunciator (e.g. fire service) is to be provided.
12. The floor pan shall be created in accordance with the Water Resources Act by an expert (with welder qualifications).
13. A type plate with the manufacturer's data, date of manufacture, filling volume is to be applied to the floor pan in a visible position.
14. A leak test shall be conducted, documented and added to the documentation.
15. Walk-on floor pans shall be covered with gratings as per DIN 24537 and Appendix 18 – Gratings. Dimensioning shall take into account the collection capacity of the floor pan shall take into account the displacement volume of the inserted gratings.
16. If the floor pan is placed directly on the floor and the floor consists of screed containing chloride (e.g. magnesite, cesalite), an impermeable film (e.g. disposal film of a min. thickness of 2 mm) shall be used as corrosion protection between the collecting tray and floor.
17. The following applies to Plants 20/27 Mannheim: Systems are to be installed with a ground clearance. This also applies to floor pans and additional components.

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25.6.8 Grease Lubrication

See Chapter "Lubrication" in Requirement Specifications II – Mechanical Components.

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25.6.9 Hydraulics

See also Chapter "Hydraulic System" in Requirement Specifications II – Mechanical Components.

1. The application of hydraulic systems at cleaning systems is subject to official approval by Daimler's respective departments.
2. If the walking beam is operated with hydraulic cylinders and hydraulic slewing motors, adjustable stops for the limits of travel shall be mounted.
3. Hydraulic rotary drives for bogies, swiveling cells, etc. shall be executed with an adjustable fixed stop or index for the transfer position.

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25.6.10 Contour, Bore, and Type Inspection

1. There shall be a (mechanical/electrical) contour or type inspection at the machine inlet. It shall be ensured that an incorrect or incorrectly installed part does not remain unidentified and cause consequential damage. Faulty parts shall not enter the washing machine and it shall be possible to remove them without additional effort.
2. The bores to be deburred (e.g. with a lance) shall be automatically checked for correct design (missing, closed, non-aligned, and non-existent bore) prior to deburring. If the bore does not exist, it shall be ensured that no treatment takes place. Furthermore, the workpiece shall be stopped at the end of the system.
3. Damage to lances and brushes shall be avoided securely.
4. The bore/plug inspection equipment shall be located in the dry area, readily accessible from all directions.
5. The fault message display shall be coordinated with the representative.

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25.6.11 Machine Housing

1. The machine is to be designed as a transportable, self-supporting construction (provide tie-down hooks).
2. A reliable access point is required for all maintenance operations and repair operations in all zones and for all assemblies (bases, stairs, ladders, walkways; design of each according to Requirement Specifications, Part II/Work Safety/Safety Equipment).
3. Safe access without the need to dismantle machine linkage components shall be provided in the process zone for maintenance and cleaning.
4. Doors shall be electrically locked and polled if there is any danger from machine movements and/or the substances behind them.
5. All exhaust air and air recirculation ducts shall be easy to access and clean via maintenance openings.
6. Washing and drying zones are to be provided with oversized doors with dog-type latches. Drip channels with a drain at the lowest point shall be provided.
7. Door elements which close automatically during the process shall be designed in such a way that they can be easily removed by one person. The guides shall be easy to mount and dismount, and shall not be welded.
8. If automatic bulkheads or doors are used for maintenance access, they should be secured in open position (with locating pins).
9. All stations shall be provided with service doors for direct access to equipment. If possible, service doors shall be fitted on opposite sides.
10. In the event of a power failure, it is not permissible for the washing chamber doors to open, due to the danger of scalding. These shall be secured by a self-latching device.

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25.6.12 Pumps

1. In this regard, also see "WSE Pump Approval List" in Appendix 17.
2. When selecting the pumps, the material approvals (BFS component approval system) of the individual plants shall be observed.
3. Manual isolating valves shall be installed upstream and downstream of all components and pumps to be replaced (minimum clearance upstream of the pumps of 2.5 x pipe diameter).
4. It shall be ensured that the pump is not damaged by incorrect positioning of shutoff devices.
5. A pressure gage (incl. isolating valve for relieving the pressure gage) shall be provided downstream of the pump and upstream of the manual isolating valve to allow the pump function to be checked.
6. The use of submersible pumps for washing water is not permissible.
7. Piping and cable ducts shall be routed in such a way that pumps can be easily removed and lifted upwards (note pipe fittings).
8. Whenever required, special fans shall be fitted to pump motors, but in compliance with the permissible noise level for the complete installation.
9. Pump installations shall be vibration-insulated.
10. It shall be ensured that there can be no buildup of chips or foreign matter on pumps and lines.
11. It shall be possible to start up the electric motor for the pumps in a controlled manner if required.

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25.6.13 Special Tools and Aids

1. Special tools form part of the scope of delivery.
2. Servicing and maintenance tools required for the removal of components and assemblies at production

equipment (inaccessible motors, fans, pumps, bungs, nozzle boxes, transmissions, filters, large flaps, etc. in cleaning systems and noise protection enclosures, etc.) shall definitely be provided.
3. Set up aids and tools required for setting up, calibrating, and operating the systems (e.g. laser pointer for nozzle alignment) belong to the system's scope of delivery (not to the product).
4. Cycle templates over at least two cycles for setting the indices and supports are also to be supplied (sheet, at least 3 mm).

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25.6.14 Clamping Devices

1. It shall be possible to adjust workpiece fixing devices, by securing them with bolts in longitudinal slots.
2. Non-axis-symmetric workpieces are to be fixed in unambiguous positions. If necessary, workpiece and pallet guides shall be provided.
3. At equipment and pallets with spring-loaded clamping devices, precautions shall be taken to prevent workpieces falling out should the spring break, by means of positive retention.

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25.6.15 Transport Systems

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25.6.15.1 Transfer Bar Conveyor Systems with and without Workpiece Carriers (Pallet)

1. Neither marks nor shadow areas may remain on workpieces. Conveying v blocks, e.g. at crankshaft and camshaft final washing machines, are to be designed with Vulkolan dovetail attachments if the workpieces are to be conveyed on functional surfaces.
2. Frequency controlled electromechanical drives are to be used for the transfer bar transport (NC controlled by means of three-phase servo motors). Motions shall be initiated smoothly, e.g. workpieces shall be picked up and deposited without jerking. Deviations permitted only with the approval of the representative.
3. It shall be possible to take components out of the machine at each station, if necessary in intermediate step of the conveying system.
4. Hardened and easily removable rollers and guide rails are to be used (e.g. v-type on one side, cylindrical on other side).
5. Movable components (e.g. rocker arms bearing brackets, guides) are to be connected to the machine's central lubrication. Bearings shall not be installed in wet areas.
6. No screw countersinks or bores are permissible in roller running surfaces.
7. If beams are long, individual sections shall be readily removable, for ease of handling during disassembly. Sufficient space for this shall be provided at the machine location, and shall be shown in the erection drawing. Actuating rod and conveying beam disconnection locations as well as bearings shall be readily accessible.
8. Indexing units may not be screwed directly into the walking beam, but shall be mounted on an intermediate plate. It shall be possible to adjust this plate in the direction of conveying by securing them with bolts in longitudinal slots. Reproducibility of the positions is to be ensured after the replacement of components (stops, dowel holes, etc.).
9. The pedestal bearing housing blocks shall additionally be secured with stops in the direction of force application.

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25.6.15.2 Comb Conveying System

1. The comb conveying system shall be low-wear and torsionally stiff. The design shall be coordinated with the representative.
2. The pedestal bearing housing blocks shall additionally be secured with stops in the direction of force application.
3. For conveying, frequency-controlled electromechanical drives shall be used. Motions shall be initiated smoothly, e.g. workpieces shall be picked up and deposited without jerking. Deviations permitted only with the approval of the representative.

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25.6.15.3 Chain Conveying System

1. The chain drive unit shall be mounted at the machine exit, so that the chain is under tension.
2. The material of the chain and link conveyor belt shall be process-conforming and resistant to substances.
3. The use of automatic chain tensioning devices is specified. Deviations shall be coordinated with the

representative.
4. The additionally required manual re-tensioning option of the conveyor belts shall consist of at least two chain links of at least 100 mm length. The tensioning device shall be readily accessible and easy to use. Provision shall be made for checking any parallel retensioning of shafts, e.g. the use of a scale.
5. Chain rollers shall run on replaceable rails.
6. The chain shall not be jammed by foreign objects (screws et.) falling into it.
7. The conveyor system shall project sufficiently beyond each end of the machine so that connecting conveyor systems will not be adversely affected by substance influences, like moisture and condensation.
8. At all times, there shall be a shackle type connector in the upper chain strand.

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25.6.16 Workpiece Carriers/Workpiece Pallets (Supplied with the Washing Machine)

1. All pallets shall be numbered and marked with an arrow to show direction of movement.
2. Drawings of pallets are to be supplied with specification of measuring points to allow the dimension to be quickly checked.
3. An inspection and setting gage shall be supplied to Daimler.
4. Bolting of workpieces to pallets is only permissible if no other clamping method is possible. This requires the agreement of Daimler.

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25.6.17 Star Feeders, Wheel Feeders, Bogies, and Swiveling Cells

1. If positioned washing is necessary, the drive for the rotation of the rotating devices is to be NC controlled by means of three-phase servo motors.
2. Turntables and their drive elements shall be easy to dismantle.
3. The workpieces shall be held with positive retention on jigs and fixtures.
4. Displays shall be provided on turntables so that workpiece location and nozzle angle detection can be registered from outside. This shall comprise a schematic with rotating workpiece outline.

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25.6.18 Cylinders and Rotary Drives (Hydraulic and Pneumatic)

1. Rotary drives and cylinders, including the piston rod section which retracts into the cylinder, shall always be mounted for easy access outside of the washing zone.
2. The dynamic forces for the attachment of the cylinders (reinforced attachment on pipes) should be observed.
3. It is not permissible to use pneumatic rotary drives in process zones.
4. The control system is to be designed in such a way that all piston rods are always retracted (to prevent them from becoming gummed up) when the machine is in home position.
5. The cylinder suspension shall always be movable; a sufficient swivel range of the hinged heads and bottom attachments should be observed.

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25.7 Dipping Machines

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25.7.1 Treatment Stations

1. The treatment stations for cleaning, purging and preservation are to be designed in the same way. They each consist of the treatment and overflow area.
2. The surface run-off is performed by means of a purging tube that shall be installed below the fluid surface to avoid foam formation.
3. No air shall enter the cleaning agent during the overflow process from the treatment area into the overflow area (avoidance of foam formation and performance restriction during ultrasonic).
4. Cleaning bath and swills shall be cascade connected (only in the direction from clean to less clean substance) if the substances used are compatible with one another.
5. The recirculation of fluid should be at least 15% at the treatment stations, with regard to the bath volume (e.g. bath volume = 500 l; recirculated amount = 75 l/min). The fluid shall be circulated without bubbles.
6. It shall be observed that a homogeneous ultrasonic field is maintained during the bath circulation.
7. Oscillation movements are required in order to achieve ideal cleaning results. Pneumatically operated jigs and fixtures are not permitted.

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25.7.2 Ultrasonic

1. The generator should be designed as follows:
    a. Modular design (generator with 4,000 W, for example, has 4 levels each of 1,000 W)
    b. Automatic power control with power display
    c. Automatic power monitoring
2. The following transducer types are to be used:
    a. Rod transducers
    b. Tube transducers
    c. Capsule transducers (hooked into treatment station)
3. The following types of transducers are NOT permitted for series production systems:
    a. Plate transducers (difficult removal if screwed and sealed onto tank)
    b. Vibration elements directly stuck onto the tanks (floor/walls)

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25.7.3 Transport

1. Insertion aids are to be installed at the loading station for the product carriers.
2. A contour query is to be made behind the loading station.
3. Drip trays (see Appendix 03) are required under the roller conveyor for the component parts to be cleaned. They are to be designed specifically for cleaning.
4. No drip trays are required under the roller conveyor for clean and dry components.

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25.7.4 Insertion and Ejection Device

1. It should be ensured that the position of the parts in the product carrier is not changed during the insertion and ejection movements.
2. The final position of the product carrier shall be safely achieved and maintained in the bogie.

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25.7.5 Bogie

1. The bogie is provided with an automatic clamping plate if product carriers of different height are turned in the treatment stations.
2. The clamping plate shall be held by clamping shears with spring tension in closed condition.
3. The clamping plate shall be opened preferably by means of pneumatic cylinders.
4. Alternative clamping systems shall be coordinated with the representative

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25.7.6 Carriage (Workpiece Transport within the Machine)

1. Positioning is performed by means of a path measuring system (limit switches are not permitted).
2. Foreign substance should be prevented from entering the treatment stations by means of carriages, belts, electrical contacts, etc.

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25.8 Spray Systems

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25.8.1 General Spraying

1. Spraying registers shall be manufactured from stainless steel.
2. The spraying system shall be easily accessible by way of service doors for setting and maintenance.
3. Spraying registers and pipes shall be executed with quick-release couplings for ease of maintenance.
4. If pipes are used as nozzles or nozzle holders, they shall not be bent several times (no swan necks) when routed.
5. If pipes are used as a distribution manifolds, the nozzles and their locations on the distribution pipe shall be numbered durably and unambiguously to avoid mixups.
6. There shall be cleaning openings at the end of pipes (caps, plugs).
7. Pipelines shall be installed in readily dismountable sections.
8. The position of the spraying register shall not be able to be adjusted for maintenance work.
9. The spray system shall not be inseparably connected (e.g. welded) to the system.
10. The nozzle layout shall be reproducible.
11. A positioning gage for the adjustment of the nozzles is to be included in the scope of delivery (see also flat-jet

nozzles). The design shall be coordinated with the representative.
12. For deluge washing, only full-jet nozzles shall be used.
13. For spray systems, a nozzle and process plan belongs to the scope of documentation (nozzle type, manufacturer, material and size, coordinate and setting dimensions, alignment to the workpiece, representation of the influencing conditions for the workpiece (water quantity and impact situation), description of the spray groups and representation of the chronological sequence).

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25.8.2 Nozzle Boxes for Targeted Washing

1. Horizontally traversing nozzle boxes shall be fitted with support and guide strips additional to the cylindrical guides.
2. Guides for the nozzle boxes shall be mounted outside of the wet area and connected to the central lubrication system.
3. Nozzle boxes for aimed washing jets shall be made by milling from the solid. Welded designs are not permissible.
4. Nozzle boxes and their covers shall be sealed with round packing cord.
5. Nozzle boxes and pipes shall be strong enough to absorb the reaction forces of the high-speed water jets.
6. The nozzle arrangement (cover/housing body) shall be coordinated with the representative.
7. Switching valves shall be provided for individual nozzle groups (to be coordinated with the representative). It shall be possible to vary the sequence of process operations.
8. It shall be possible to check the spray and jet direction of nozzles with laser pointers. Two bores with plugs are to be applied in the rear wall of the nozzle boxes directly behind two diagonally aligned nozzles to enable the accommodation of a laser pointer.

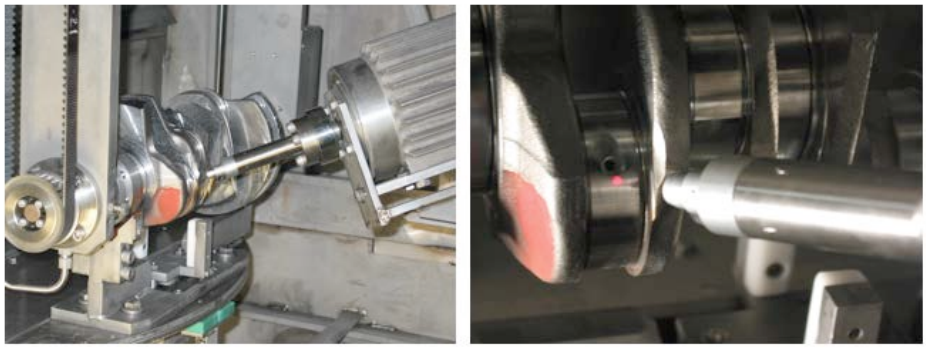

Fig.: Example of the inspection of the direction of the nozzle jets with laser pointers

9. Nozzle arrangements on one level only per nozzle box; deviations shall be coordinated with the representative (no wraparound U- or L-shaped nozzle boxes due to alignment problems).
10. For aimed washing, the pattern of holes in the nozzle box should match the workpiece.
11. To ensure aimed cleaning, the nozzle boxes are to be adjustable on all levels (including rotational).
12. Nozzle boxes shall be equipped with quick-fit pipe unions or pipe fittings for ease of maintenance.
13. The infeed lines to the nozzle boxes shall have a cross-section with an appropriate ratio to the cross-sections of all nozzles.
14. The pressure and jet intensity shall be presented to the representative.

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25.9 Filling and Metering

1. Before the contract is awarded, it shall be clarified with which the substance the system is to be filled (drinking water, DI water, washer fluid, cleaning agents, cooling lubricant, etc. or other chemicals). The use of substances not available on-site is permissible only with the express approval of the representative (handling permission/hazardous material approval).
2. No feedback in the individual substance networks shall occur as a result of feeding different substances.
3. The water for machines supplied with water (drinking water, plant water) shall be supplied/filled via a funnel (DIN 1988).
4. For each system, the substance feed shall take place via a central feed point to be specified in consultation with the representative.

5. The following applies to Plants 20/27 Mannheim: The implementation of a mixing unit for mixing multiple substances shall be coordinated with the representative in consultation with the relevant department.

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25.9.1 Filling, Supply and Disposal of Centrally Supplied Systems

1. Filling with washer fluid from the central supply system is carried out via a lockable manually operated valve, followed by an automatic main stop valve, which close automatically in the event of a power failure (electricity, air).
2. At washing machines with 100% washer fluid exchange, a washer fluid inflow regulation system in accordance with the Appendix 12.3 shall be provided to avoid pressure surges in the supply line.
3. At washing machines with 1-99% washer fluid exchange, a bypass should be installed behind the main stop valve for the overflow / washer fluid exchange in the event of low substance requirements. This shall include a manual ball cock or manual valve to regulate the flow and shut it off. The automatic quick filling valve is mounted in the main line downstream of the bypass line.
4. The overfill protection switch in the bath tank closes the automatic main stop valve (self-closing in the event of a power failure) in the case of overfilling.
5. In the case of centrally supplied machines with return flow pump, overflowing shall be ruled out even when if the machine is shut down (weekend, repairs); provide a separate switch cabinet for the pump (supply upstream of the main switch). It is not permissible for the return pump to be circumvented by a bypass line (backflow from supply line).

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25.9.2 Filling of Self-Supplied Systems

1. Carry-over of washing agent shall be minimized during the cleaning process.
2. The basic filling of self-supplied machines shall be implemented as quickly as possible. The filling time shall be disclosed in the bid.
3. For self-supplied machines, the water supply line/filling provided at the plant shall be provided via a funnel (EN 1717).
4. If reverse osmosis systems are also ordered for producing deionized water, consultation with the representative is required.
5. If metering equipment is required, essential details (delivery container, tank volume, metering system, etc.) shall be coordinated with the representative.
6. A connection for a cleaning hose (incl. stop cock) is to be provided behind the shut-off valve and in front of the water counter (if available) in the fresh water supply.

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25.9.3 Automatic Re-Metering

1. The chemicals are re-dosed automatically at each cleaning station by means of metering pumps. A sufficient chemical volume is to be secured by means of a "minimum fill level" sensor with electrical contact (part of the re-metering unit).
2. Re-metering by means of cascade is not permissible for the initial filling.
3. The re-dosing quantity is either determined by means of chemical analysis (by Daimler's department) or automatically added in proportion to the quantity, depending on the product throughout and fluid carryover. The precise re-dosing ratio is based on empirical values of similar systems or shall be determined by trial operation. Sufficient mixing of the substances should be ensured by forcing a turbulent flow in the mixing area with appropriate components.
4. A three-way cock is to be used at each station for gaging the re-dosing quantity. In individual case, the actual values of the dosing quantity may vary considerably from the nominal values in the event of cleaning agent concentrations of high viscosities. In these cases the instructions of the dosing system manufacturer should be observed.
5. The chemical storage tanks should be installed in such a manner to rule out any risk of groundwater pollution. The tank can be installed within the collecting tray of the system or in a separate collecting tray. The retention volume shall be sufficient to allow the contents of the delivery container to be accepted.
6. Online monitoring of the cleaner concentration and oil particles in the cleaning substance shall be coordinated with the representative.

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25.9.4 Manual Re-Metering

1. The addition of operating water and de-ionized water and the corresponding cleaning agent concentrates shall be possible for each individual tank.
2. The re-dosing process shall be able to be performed by a "single" employee.
3. The entire metering concept shall be coordinated with the representative.

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25.9.5 Complete Desalination (DI) and Reverse Osmosis Systems

Should a reverse osmosis installation be required for providing deionized (DI) water, this shall be selected in accordance with Plant/Center stipulations or following agreement.
The site-specific discharge limit values are to be adhered to when discharging the accumulated waste water.

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25.10 Circulating Pumping Stations

For requirements, see Chapter 2.8

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25.11 Heating and Cooling

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25.11.1 General Information

1. The design of the heating system (electric or hot water) shall be coordinated with the representative. Sufficient process heat may not be available the whole year.
2. The heating shall be installed in such a manner to allow simple removal without draining the washing or purging agent as far as possible.
3. The substance thermometer shall not be located nearby heating elements.
4. The process pumps shall be operated cyclically and the bath circulated during the heating-up process. As a result, the substance in the pipelines and power take-off units are heated up.
5. The actual temperature and the operating temperature limits (min./max.) shall be displayed on the control panel. Violations of the operating temperature limits are to be indicated as warnings. The system is set to "stop after end of cycle", restart by means of manual selection.
6. If heating registers are used in the washer fluid tanks, they shall be flanged so that they can be withdrawn (flanged plate is to be insulated like a tank). The flange plate should be of rectangular design (see Chapter "Materials" for material 1.4571 - V4A).

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25.11.2 Electric Heating

1. Electric heating may be used only in special cases due to the high electricity costs.
2. Special cases are, for example:
    a. No or insufficient hot water network at the plant.
    b. Only low heat outputs are necessary, e.g. up to approx. 15 kW (possibly for small systems). Written approval of the representative required.
3. The maximum heat-up time of the substance shall not exceed 4 hours.
4. A square piping layout is required for improved cleaning in the event of directly heated baths with heat supply by means of heating coils.

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25.11.3 Hot Water Heating

1. The washer fluid shall be heated up with hot water in no more than two hours. Longer heating-up times shall be coordinated with the representatives. If process heat is used, the return temperature limiter shall be adjustable to meet plant-specific specifications.
2. It is not permitted to install heat exchangers in the treatment basins of dipping machines. Heating by means of external heat exchangers (capable of being shut off).
3. The installation of the heat exchangers in the storage tank is permitted if filtered substance flows there (clean tank) and no dirt can enter it.

1 5 6 7 9

25.11.4 Heat Exchangers

1. The use of heat exchangers shall be coordinated with the representative depending on the heating substance used.
2. Purging connections with isolating valves are to be provided upstream and downstream of the heat exchanger.

1 5 6 7 9

25.11.5 Temperature Regulation

1. The temperature is to be controlled by means of a temperature regulator with separate setpoint adjustment (35-80°C).
2. The associated manual isolation valve as well as a controlled shutoff valve for the heat exchanger which is timer-controlled according to a weekly schedule shall also be provided.
3. The power supply to the clock timer shall be upstream of the main switch in compliance with the relevant VDE guideline.
4. The controlled shut-off valve is to be integrated downstream of the main switch and upstream of the control voltage.

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25.11.6 Workpiece Cooling

1. Cooling zones are to be decoupled air-specifically to prevent any humid air from being extracted from the cleaning system.
2. The drying area (blow-off station) shall be separated spatially from the cooling area since chips may otherwise block the cooling fins.
3. The formation of condensation shall be kept to a minimum. Any condensate which accumulates at the refrigeration unit is to be collected specifically.
4. Cooling units: The component parts can be found in the MFL (in BFS).
5. The conveying system through the cooling zone shall be resistant to corrosion, particularly its bearings, rollers, shafts, and chains.
6. The coolant requirements are to be specified in the bid.
7. Any re-soiling of the components, e.g. due to cooling air, shall be ruled out.

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25.12 Workpiece Drying

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25.12.1 Drying Results

1. If workpiece drying is carried out in the system, no substance drops and no drop residues shall remain on the workpiece. The cleaned components shall be without residue and dry in accordance with the component-specific requirements.
2. The residual dirt requirements shall be observed during the drying process. Re-soiling of the component parts due to insufficiently cleaned air for drying must be avoided by all means.

1 5 6 7 9

25.12.2 Machine Design

1. The major units of the drying zones shall be aligned in such a manner to prevent any fluid from accumulating in the lines or in the devices e.g. in the event of machine downtimes.
2. The blow zone shall be pressure relieved (neutral zone between the blow and washing zones), so that substance vapors and heat cannot be forced out by the blow air.
3. To maximize the efficiency of the drying process, preliminary blow off of components prior to actual drying (e.g. during the transportation phase) shall be considered.
4. Return of substances from blow-off and dry zones into wet zones or tanks shall be carried out using a sloping floor and an adequately dimensioned return line.
5. A ring-circuit flushing system or rotary nozzles shall be planned in the drying zone to allow the blowing cabinet to be cleaned at programmed intervals and durations. Additionally, manual rinsing equipment shall be provided. Rinsing shall be carried out with washing substance or cooling lubricant. No impermissible substance mixtures, e.g. oil with water, shall occur.

1 5 6 7 9

25.12.3 Documentation

1. The drying system (e.g. air-blast boxes, individual air-blast nozzles, vacuum drying, etc.) shall be added completely to the documentation in the same way as the spray nozzle system.
2. This includes a well-illustrated nozzle plan with the complete set of technical parameters (connection dimensions, coordinates, setting dimensions, nozzle type, nozzle diameter, installation position, air volume specifications, etc.).

1 5 6 7 9

25.12.4 Drying with Air

1. The drying process shall preferably be implemented without exhaust air and emissions using the recirculated air procedure with heat recovery. The waste heat that is incurred shall be fed back to the drying process.
2. The system shall have generously dimensioned cleaning openings. The air drying system temperature shall be adjustable and displayed on the control panel.
3. Both the circulated air as well as the flowing fresh air are to be filtered according to the residual dirt requirements. For this purpose, a filter is required on the pressure side of the air circulation fan. Metal fabric filters are recommended due to the high temperatures. Use of these is mandatory at temperatures > 80°C.

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25.12.5 Vacuum Drying

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25.12.5.1 General Information

1. Faultless vacuum drying is only possible if the components to be dried have a sufficient minimum heat capacity at each contour element, scooping workpiece areas are only moistened with fluid on the surface and there is no accumulation of stagnant substances. Horizontal surfaces are to avoided as far as possible (tilt workpiece if necessary).
2. Only a maximum absolute pressure of 50 mbar may prevail during drying.

1 5 6 7 9

25.12.5.2 Vacuum Chambers

1. The vacuum chamber is to be made as small as possible. In some cases, the vacuum chamber will have to be made adaptable to the size of the component (e.g. to line dead zones with vacuum and substance-resistant formed parts).
2. Arrangements to clean the vacuum chambers shall be in place. They shall be provided with ports to allow the use of a high-pressure cleaning agent.
3. A cleaning agent drain shall exist (ball cock with coupling).
4. When cleaning vacuum chambers, it is not permissible for cleaning substances to come into contact with the machine floor pan.
5. For maintenance purposes, vertically closing vacuum devices shall be equipped with a downward movement blocking device.
6. The vacuum chamber is to be protected against condensation on the chamber walls, in particular in the ceiling area. Workpiece dripping may have to be avoided by heating.
7. On single-chamber washing machines, the supply and return lines shall be blown free before beginning with vacuum drying to remove residue from the lines and protect the vacuum pump against wear/water ingress.

1 5 6 7 9

25.12.5.3 Vacuum Pumps

1. The choice of vacuum pumps shall take into account the supplier approvals. The component parts can be found in the MFL (in BFS)
2. The intake air to the vacuum pumps shall be filtered.
3. To protect vacuum pumps against accelerated wear, a vacuum meter (electrically monitored) for monitoring the exhaust back-pressure and the degree of contamination of the air de-oiling elements shall be installed in the exhaust chamber.
4. Pump exhaust air shall not be discharged into the hall without treatment.
5. Pumps shall be equipped with monitors for oil filling level and oil temperature, with preheating.
6. Pump discharge lines shall be designed according to the manufacturers' data (add at least one third to the pipe cross-section).
7. If the discharge pipe has to be directed vertically upwards, a condensation water catch tank with drainage

cock shall be installed at its lowest point.
8. The vacuum intake line must be so routed that it is not possible for liquids to run back and foul the workpiece.
9. The pump oil filling point shall be easily accessible when the pump is installed.
10. The pump shall be installed insulated from vibrations.
11. Vacuum pumps shall be set up to manufacturers' specifications. There shall be sufficient spacing from neighboring components for optimal pump cooling. Adequate air circulation shall be ensured. Pumps positioned above each other are to be installed at sufficient spacing.
12. Only Daimler-approved oils shall be used (consultation with the representative).

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25.12.6 Blowing Off with Compressed Air

1. Compressed air is the most expensive type of energy at the plant, Because of this, it may be used only in order to avoid expensive investments. An example for this is the drying of a blind hole bore with a targeted compressed air blast. Special approval from the representative is always required for blowing off with compressed air.
2. The re-soiling of the components by compressed air is to be avoided by all means. It shall be de-oiled, drained and freed from solid particles by appropriate measures on the system (as close as possible to the consumer), depending on the cleanliness requirements.

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25.12.7 Blowing off with Side Channel Blowers

1. In numerous case the application of side channel blowers (high-performance blowers) is sufficient to save hot-air driers and compressed air energy. Re-soiling of the components air is to be avoided by all means by taking appropriate filtration measures.
2. The filters should be monitored electrically for contamination if side channel blowers are used.
3. The drives of the side channel compressors in pulsed processes shall be equipped with a frequency converter if the power exceeds 7.5 kW.
4. Side channel blowers shall be designed and installed for easy maintenance.
5. The choice of side channel compressors shall take into account the supplier approvals. The component parts can be found in the MFL (in BFS)

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25.12.8 Drying with Circulated Air or Shop Air

1. Prior to air-blasting, workpieces which scoop up substances shall be emptied.
2. Regenerative compressors or, alternatively, low-pressure fans, shall be used for the process.
3. For drying with recirculated or shop air, the air has to be cleaned (filtered) and, if necessary, cooled. Filters shall be monitored.
4. The filters used to clean the blowing air are to be of quick exchangeable design to allow them to be replaced within 10 minutes if required and the clogged filter to be cleaned outside the machine. Air filters are to be arranged in such a manner to allow easy maintenance.
5. For recirculation blow-off systems, deposits of oil, dirt, and washing substances downstream of the air filter shall be prevented.
6. In order to minimize emissions from the system, no more than 25% fresh air feed is permitted for circulation drying.
7. The blow-off nozzles and masking screens are to made adjustable, reproducible and stiff.
8. The space between the blow-off nozzles and the workpiece shall be reduced to a minimum. It shall be ensured that when in use, nozzles are acting only in the direction of the workpiece.
9. Blow-off nozzles shall be made aerodynamically efficient, with targeted and low-loss air flow (using the Venturi principle where applicable).

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25.13 Exhaust Air Equipment

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25.13.1 System Extraction

1. Preference shall be given for emission-free recirculating air systems to be used.
2. The discharge of residual vapors via the roof or the building extraction system requires the special approval of the representative.
3. Cleaning systems shall be equipped with a system for retaining vapors and condensation, even if they are

connected to external machine extraction systems.
4. The extraction system shall offer freely programmable power-down.
5. Direct extraction of fumes (vapor) from the washing chamber is not permissible. It shall also be ensured that no swirled-up washing substance or HP substance is suctioned off directly through vapor condensation during the machining process.
6. To prevent vapors and drying air from mixing, vapors shall be suctioned off at the machine inlet. Cross-flow through the process zone shall be avoided.
7. To prevent the accumulating condensate from dripping back onto the transport system, a condensate/penetrating oil separation option shall be installed at each measurement point. The condensate/penetrating oil shall be collected in a separate condensation collecting tank.
8. Each extractor fitting is to be provided with a butterfly valve or a similar device in order to regulate the air volume to be extracted.

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25.13.2 Vapor Condensation

1. If the washer fluid temperature is above room temperature, vapor extraction shall be implemented by means of condensers (deviations permitted following consultation with the representative). Emissions of vapor into the shop are not permissible. Closed-circuit condensation systems shall be used. The system selection shall be coordinated with the representative.
2. The supplier approvals shall be taken into account in the choice of vapor condensation system (see the MFL in BFS; consultation required with the representative in conjunction with the Cleaning Technology Competence Team). The vapor condensation for the cleaning and rinsing zones shall preferably be implemented without exhaust air and emissions using the recirculated air procedure with WRG (heat recovery). The waste heat that is incurred shall be fed back to the cleaning and drying process.
3. The parameters required for the layout of the air system, such as volumetric flow rates, temperatures, and humidity values, shall be submitted. Approval is given only afterwards by the Daimler planning department or the department in concern.
4. The heat exchangers shall be designed resistant to the substance that is used. This shall be ensured by the supplier. Cooling or cold water connections to the shop network shall be designed with fixed piping with threaded connections (not hoses).
5. The heat exchangers shall be equipped with a rinsing system. Cyclical rinsing shall be coordinated to the production conditions.
6. Safe access to all functional units shall be ensured.
7. All heat exchanger drain lines shall be routed with a sufficient downgrade. (minimum pipe diameter of 1").
8. Furthermore, generously dimensioned cleaning openings are to be provided.
9. Cleaning nozzles supplied with a clean medium from the washing bath are to be installed in the vapor condensers. The cleaning fluid is to be drained into the used substances tank to be provided by the customer to prevent any sludge or bacteria from entering the wash baths. These cleaning nozzles are cyclically put into service for purging as required.
10. All assemblies shall be able to be easily removed by means of screw connections.

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25.14 Thermal Insulation and Sound Protection Insulation

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25.14.1 Insulation of Hot Surfaces

1. The regulations of DIN EN 563 "Protection against burning on hot surfaces" are to be observed.
2. The specified insulating material thickness is to be adapted to the technical requirements and operating temperatures applied.
3. The insulating materials shall have a thermal conductivity lambda of 0.035 W/(m*K).
4. If materials with other lambda values are used, the thickness of the insulation shall be converted accordingly.
5. Insulations on the basis of mineral fibers shall meet the requirements of construction material class A1 or A2 according to DIN 4102.
6. Soft foam insulations shall meet the requirements of construction material class B1.
7. Separate insulation is to be applied to all flanges. The flange connections shall remain identifiable from the outside and the insulation shall be easy to remove without problems as far as possible in order to perform work on the pipelines.
8. All system components in which heated substances are used (e.g. substance containers, tank caps, hot water lines of the machine (supply and return), flange plates, hot-air driers, air duct systems, filter housings) shall be

insulated at least as per VDI 2055.
9. Insulation which is easy to remove (Velcro fasteners or lacing hook), not damaged or infiltrated by leaks, ensures access to lubrication points, measuring and setting devices and does not impair operability is applied to all system components such as heat exchangers, heating circulation pumps, fittings, measuring instruments.
10. If possible, the entire system (encasing), including the side walls and the machine roof, should be completely isolated.
11. On dipping machines, the baths shall be shut by means of insulated lids whenever there is no component being cleaned.
12. The insulation may have to be customized on site. Labels are to be applied to avoid confusion and facilitate installation.
13. High-pressure pumps shall be designed without insulation. All other high-pressure components shall be insulated.

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25.14.2 Insulation of Cold Surfaces

Cold surfaces on which condensation may form from the humidity of the inside air are to be insulated. These are usually lines/hoses (from transfer point) and condensers which carry cold water generated in a chiller unit. Fittings are to be insulated with reusable collars. Lines for circulating water do not require any insulation, since there is no risk of condensation. The insulation is to be diffusion-proof.

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25.14.3 Material for Heat Insulation and Protective Sound Insulation

1. Only non-combustible insulating mats with hot-dip galvanized sheet metal (plant-specific, possibly brushed stainless steel) are permissible as heat insulation and sound insulation cladding (surfaces).
2. Surfaces: insulating and noise insulation materials are to be protected by plastic sheeting against absorption of moisture and mechanical damage.
3. Surfaces: VDI 2711 "Sound Protection by Encapsulation" stipulates that: "usually a glass fabric or pressed fiber fleece is additionally applied to protect the absorption material against contamination or from falling out. To prevent the ingress of combustible components (e.g. oil) or moisture, cladding of the soundproofing material with a plastic film (10–20 µm thick) is unavoidable in certain cases; this shall be positioned loosely in front of the soundproofing material. This sheeting only reduces the absorption of high frequencies to a slight degree."
4. As a rule: It is not permissible to use synthetic mineral fibers that do not meet the approval criteria of Appendix IV no. 22 of the hazardous material index (GefStoffV). Ceramic additives are not permissible.
5. Pipes and lines can be insulated with closed-pore plastic foam elements (see BFS component approval system).

1 5 6 7 9

25.14.4 Noiseproof Enclosures

1. Lighting is to be installed in noise protection cabins in accordance with the ASR (guideline from the authorities for working areas).
2. in the form of easily removable damping elements with a base frame. Large-area noise insulation elements shall not be used.
3. Panels are to be screwed onto profiles.
4. A ventilation system may have to be provided with an active fresh air supply from the hall area. Component overheating shall be prevented.
5. Cabinet doors shall be fitted with sturdy hinges and locking devices. A handle for opening the door from inside is stipulated by regulations.
6. Easily accessible EMERGENCY STOP switches are to be integrated in noiseproof enclosures.

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25.15 High-Pressure Deburring

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25.15.1 General Information

1. The substance supply line cross-section diameters shall be coordinated with the representative.
2. Workpieces shall remain clamped into workpiece carriers, chucks or jigs and fixtures under mechanical spring pressure. An additional mechanical locking device shall stop the workpiece from falling out should the spring

break. Only springs of stainless steel are permitted.
3. Sealing of male fittings with hemp packing, adhesives and plastic sealing strip is not permissible. For sealing fittings in the HP system, only base seals, lenticular gaskets and conical seals shall be used due to the danger of jet spray from the thread. A relief bore shall be provided downstream of the seal.
4. Readily accessible inspection ports with hinged covers shall be provided at internal exhaust and recirculation air ducts.
5. The rundown tank/clean substance tank shall be equipped with temperature monitoring.
6. Wear to and leaks in the individual high-pressure lines shall be able to be identified reliably.

1 5 6 7 9

25.15.2 High-Pressure Pumps

1. Each HP pump shall be supplied from its own pressure booster pump. The pressure boosting line shall conform with the pump manufacturer's regulations
2. Shutoff cocks shall be installed upstream of all booster pumps.
3. A pressure gage connection pipe shall be installed between the booster pump and HP pump, to check the inlet pressure.
4. A high pressure tank (pure substance tank) is prescribed for degassing and stabilizing the cleaning agent. The tank size is to be dimensioned sufficiently according to the pump flow rate and the substance used (clean tank volume = min. 5 x pump delivery flow rate in liters per minute). A tangential inflow shall be implemented by means of an immersion tube to calm the bath surface. The tank shall be closed with a cap. Filling of the main tank (if available) to overfill the HP tank (continuous overflow is necessary to separate oil and fine dust particles) so that the bath filling volume is constant. Separate bath circulation or complete draining in the event of system downtime shall be coordinated with the representative (avoidance of bacterial contamination of the medium). A drainage possibility for the HP water tank shall be provided. The booster pump is to be connected to the HP tank (relief tank to prevent cavitation). The supply to the booster pump is to be provided at approximately 1/3 of the tank height.
5. The piping between the booster pump and HP pump shall be as short and direct as possible. Vibration decoupling shall be provided on the suction and pressure side of the high-pressure pump (HP hose pipes and HP lines). The component parts can be found in the MFL (in BFS)
6. The electric motor for the HP pump shall be equipped with a frequency converter. Pressure regulation is to be implemented.
7. All HP pumps shall be fitted with safety valves. This is purely a safety feature. The process shall not allow any substances to be directed back through the safety valve. No regulation via bypass valves. 100% of the medium shall be fed to the process. The return line from the safety valve shall be visible at one point to check the valve (substance flow). Leakage collection lines shall be routed to a tank so that they can be viewed.
8. Rule 237 of the German Employers' Liability Insurance is to be observed for the hose routing. For the same nominal diameter, all hose lines shall be of equal length, with fixed pipe sections provided to make up the difference.
9. The maintenance schedules prescribed by the HP pump manufacturers shall be programmed in the tool change screen at unit and principal operating panels. A preliminary warning shall be issued in good time without stopping the machine.
10. For the selection of HP pumps: The component parts can be found in the MFL (in BFS). Coordination with the representative is required.
11. If a cooling circuit is required for the HP pump, it should be temperature controlled.
12. The cooling circuit of the plungers (pistons) shall be illustrated clearly directly next to the HP pump (picture laminated in film).
13. If HP pumps are belt driven, multi-stranded high-strength belts shall be used. The setting for the belt tension shall be shown.
14. For alignment and tensioning of the belt drive, setting screws shall be provided.
15. The time for build-up to high pressure is to be monitored. Should this take too long, an alarm shall be issued at the operating panel. No lengthening of the cycle time is permissible.

1 5 6 7 9

25.15.2.1 Function Test for High-Pressure Pumps with Test Nozzle

1. A test nozzle for the determination of the power to be achieved (pressure and flow rate) by the HP pump shall be firmly installed.
2. The test sequence is performed by manual selection in the control system.

3. A separate substance supply, HP test nozzle, HP valve and where applicable a switch-over valve (test/machining process) are to be provided on the hardware side.
4. If all HP tools at HP systems are permanently in use (steady-state system), the test nozzle shall represent the total cross-sectional area of all nozzles used.
5. At HP systems where various HP tools are operated at different process pressures (variable HP system), the test nozzle shall represent the total cross-sectional area of the HP tool which will be run at the highest operating pressure.
6. The test sequence shall be coordinated in detail with the representative.

1 5 6 7 9

25.15.3 High-Pressure Pump Station

1. The pump interior of a HP system is to be designed as noiseproof enclosure.
2. For servicing and maintaining the HP pumps and associated electric motors, the necessary aids shall be coordinated with the representative (e.g. rail with overhead trolley for attaching a hoist).

1 5 6 7 9

25.15.4 Rotary Drives of High-Pressure Tools

1. Only electrically or hydraulically driven rotary drives are permitted.
2. The adjustable speed range shall be coordinated with the representative.
3. The speed is to be monitored in the equipment control and the system stopped and an unambiguous error message issued in the event of deviations from nominal values.
4. The component machined when the fault occurred is to be ejected. Repeated machining after eliminating the fault is to be checked.

1 5 6 7 9

25.15.5 Rotary Feed Throughs

1. The amount of leakage of rotary feed throughs shall be documented.
2. The leaking water can be led out of the work chamber through a collection hose and collected in a small transparent tank. Permissible amounts of leakage are to be specified in the documentation.

1 5 6 7 9

25.15.6 High-Pressure Lines and Threaded Connections

1. The ends of HP hose lines are to be secured with catch stockings.
2. HP hose lines shall not be longer than 4 m.
3. Hose brackets shall be designed in such a way that no damage can be caused to the hose line by pressure peaks, longitudinal expansion and vibrations.
4. Depending on hose length, its attachments may have to be floating.
5. HP hose lines shall not come into contact with other hoses or components in the event of load changes.
6. If hose connections outside of the machine cladding are unavoidable, these shall be equipped with burst protection (personnel protection).
7. Terminal plates and distribution plates for HP hose lines shall be provided with a reinforced holder/fastening fixture to prevent deformation to the plate bracket (bulkhead plate) when undoing and tightening the hose nuts.
8. The use of energy supply chains is not permissible.
9. Bent, spiral-type HP pipes are permissible as flexible connection pieces between the HP pump and firmly installed pipelines. They shall be installed professionally and autofrettaged in order to increase the durability, depending on the pressure range. Refer to the BFS for permitted suppliers.
10. For HP threaded connections in stainless steel, a separating agent shall be used on the thread. The separating agent can be found in the MFL (in BFS).

1 5 6 7 9

25.15.7 High-Pressure Process Zone

1. No chain conveyors or transfer bar conveyors are permissible within the process zone (except for HP systems integrated in washing machines). Transport systems shall be clarified with the representative.
2. Within the process zone, no electrical parts, rubber buffers, rubber-metal mounts, singling devices, stoppers or recirculating ball spindles shall be installed.
3. Electrical connectors, transmitters, electric motors, ball spindles, guideways, proximity switches and valves shall be protected by guard plates against escaping spray water or hose lines bursting outside the process zone.
4. At lubrication systems in the process zone, a return line to the outside shall be installed to prevent the high-

pressure substance from becoming soiled by oil and grease.
5. The process zone and all components within it shall be made completely of stainless steel.
6. A guard/baffle plate (approx. 20 mm thick, consisting of C45) shall be applied within the process zone opposite to the high-pressure nozzles if process-related damage to system components by the high pressure jet is expected. These plates shall be of low cost and easy to replace.
7. If high pressure is applied to bores and passages, the surfaces subjected to the emitted water jet (e.g. conveying v-blocks) are to be protected from the high-pressure jet.
8. The doors to the process zone shall be generously dimensioned, so that nozzles can be changed out and other maintenance performed without loss of time.
9. To avoid dirt buildup in the system environment due to drained water with the process zone doors open, a water drain channel shall be applied to the bottom door area. The drained water is to be returned to the process zone.
10. Segmented aprons in the process zone shall be of full metal construction (see Plant/Center stipulations).

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25.15.8 High-Pressure Jet Tools

1 5 6 7 9

25.15.8.1 General Information on Nozzles

1. Nozzles shall be so arranged that they will not damage each other.
2. Nozzles shall be easily replaceable and readily accessible.
3. Pressure relief bores shall be provided upstream of the joint and downstream of the sealing location.
4. A nozzle plan with the coordinates, alignment and setting dimensions and cycle plan shall be created for the nozzle boxes, with illustration of the nozzle type and size.
5. The nozzle plan and all details of the jet tools belong to the scope of the documentation subject to official approval.

1 5 6 7 9

25.15.8.2 Flat-Spray Nozzles

1. To rule out any deviations from the designed ideal position e.g. due to nozzle replacement, flat-spray nozzles shall be defined in clearly reproducible positions (nozzle's angle of rotation).
2. A wear-resistant, clearly visible mark on the transverse slot of the flat-spray nozzle (direction of the line spray pattern is always parallel to the milled in nozzle slot) shall allow the angle of rotation to be positioned in relation to the nozzle holder.

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25.15.8.3 Full-Jet Nozzles

A laser pointer with adapter is used to check the impact position of full-jet nozzles. The laser pointer shall be supplied with the system. An operating manual is to be included in the documentation.

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25.15.8.4 Lances

1. The presence of bores treated with a lance shall be verified first automatically at the machine inlet.
2. The lance feed is to be driven by three-phase servo motors under NC control.
3. The lance is positioned with the lance guide no more than 5 mm away from the contour of the part.
4. Lance holders are to be position-oriented with no risk of confusion.
5. There shall be no risk of confusion in terms of the installation length.
6. Overrun and breakage monitoring of the lances shall be coordinated with the representative.

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25.15.9 Substance Supply and Filtration

1. HP systems shall be of self-sufficient design. Background: substances from central systems are usually filtered at a nominal value of 105 µm. This substance quality is insufficient for high cleanliness requirements, so that refiltering is necessary at the HP system. If this were done, the medium from the central unit would be filtered by means of HP filtration (e.g. 20 µm absolute filter), which experience has shown increases filter wear and is uneconomical.
2. Water hardness of 3-6°dH (German degree of hardness) is to be set for the new approach. This is achieved by adding DI water to the drinking water at a correct mixing ratio by means of automatic dosing (mixing unit, machine's scope of delivery) (calculation on site by the respective department).
3. The operation of HP pumps with pure DI water is impermissible, since non-ferrous metals (sockets, etc.)

and components to be cleaned may be corroded by aggressive DI water.
4. To prevent salting (increase in water hardness) of the substance, the evaporated substance is automatically re-dosed with DI water. The necessity of adding cleaning agent (removal by carryover) shall be checked (see Chapter "Filling and Dosage" for re-metering methods).
5. An absolute filter is required upstream of the high-pressure pump. The higher differential pressure of the absolute filter element is to be taken into account for the design of the booster pump.
6. The filtration concept shall be coordinated with the representative in consultation with the relevant department.

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25.16 Filtration of Cleaning Agents

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25.16.1 Notes on the Filtration Arrangement

1. Filter systems are to be positioned on the pump pressure side.
2. For the pump design, it should be observed that the maximum possible differential pressure of the filter can be used (pump pressure = max. filter differential pressure + operating pressure + line resistances). The max. possible differential pressure of the filter element is to be visualized by the contamination indicator (see also Chapter "Differential pressure monitoring").
3. The optimization of filtration in operation by elements with higher differential pressure potentials shall be possible without falling short of the minimum operating pressure (provide pump reserves). Optimization can be performed, for example, by replacing bag filters with candle-type filters or nominal filters with absolute filters to achieve a longer service life. This shall be coordinated in advance with the representative.
4. The maximum pressure shall be lower than the permissible nominal pressure of filter housings.
   The permissible pressure in the filter system shall not be exceeded even when operating a pump against a closed isolating valve.
5. The filter housing shall not run dry (solidification) if the cleaning substance is shut off. If this is not directly possible due to the design of the filter housing, the piping run is to be designed accordingly. Backflow in the filter housing (flow against the defined direction of flow) is to be avoided.
6. The flow rate shall be sufficient, v_{min}= 2.5 m/s; v_{max}= 4.0 m/s in order for fine particles to be carried along by the flow in the pipelines after filtration and dispersed again after the system downtime (avoidance of particle accumulation). Pressure losses are to be maintained at a low level in the process. The noise development due to fast flowing substances is to be taken into account.
7. Filter cleaning and replacement shall be possible with interlinked and cycle-dependent systems without long machine downtimes (possibly use of change-over filters). The concept shall be coordinated with the representative.
8. Filters shall be easy to access and service.
9. Constant operating pressure is ideal for filtration processes, since otherwise partial impact loads of the filter will occur and particles may be able to be pressed through the filter. Pressure shocks shall be eliminated, for example, by restricted valve switching processes or pressure dampers. Air bubbles shall be avoided at all times.
10. The defined separation rate shall be guaranteed for the filter up to the final differential pressure (Δp). The separation efficiency shall prevail over the entire operating time of the filter (process reliability).
11. The filterabilty of the cleaning agent shall be given in the event of small pore widths. Otherwise cleaning agent components may be removed by the filter (filter blockage and dilution of the cleaning agent).
12. The chemical and thermal resistance to substances of the filter material and the seals (e.g. acrylnitrile butadiene rubber, FKM) shall be ensured with the cleaning agent. The carryover and hence the contamination of various treatment zones within a cleaning system with cooling lubricant, cleaning chemicals or preservation chemicals is to be taken account and if necessary verified by laboratory tests. The filter materials and seals used shall exhibit the required temperature resistance.
13. Material filter housing: see Chapter "Materials".

1	5	6 7	9

25.16.2 Automatic Backwash Filter

1. Backwash filter systems can only be used to remove coarse particles (e.g. 25–2,000 µm) (nominal filtration). The nominal filtering capacity cannot be compared to that of an absolute filter.
2. The automatic filter is regenerated by means of timer control and additionally by means of differential pressure control. In this case differential pressure control serves only for purposes of safety.
3. The regeneration process may only be performed under pressure, i.e. sufficient substance shall be available

for the subsequent filling (risk of solidification).
4. The regeneration process shall not influence the system operation negatively. During the regeneration it shall be ensured that the operating flow rate required for the process is still available.
5. The backflush product is preferably to be intercepted by a secondary filter and removed from the substance circuit. The disposal concept for solids (tanks, containers, chip carriages, etc.) shall be coordinated with the representative.

1 5 6 7 9

25.16.3 Housing Design of Non-Backflushable Filters

1. The pipe lines are to be mounted on the filter housing free of tension. Vibrations and impact on the housing are to be compensated.
2. Eye bolts or handles are to be used (no hexagon bolts) for filter housings with screw caps in order to open them quickly.
3. The max. cap weight for manual handling is 15 kg. A hoist or cap swing device is to be provided if the cap weight is greater.
4. No direct inflow on the filter elements is permitted. Appropriate protective measures (e.g. indirect inflow area or baffle plate installation) shall be taken in the inflow area.
5. Thermal expansion of elements due to high temperature shall be compensated in the housing by appropriate measures. It is not permissible to bend or twist the elements in the housing.
6. Centering of the elements is required in the housing.
7. No drawbar solutions are permissible for the element holder.
8. The element holder shall be welded tightly in the housing. Adhesive variants are not permissible due to the risk of leaks.
9. The element holder (plug-in point) in the housing shall be designed according to the rules of sealing technology (peak-to-valley height, form tolerances, and tolerances of position, sealing concept filter elements). Substance slip is not permissible.

1 5 6 7 9

25.16.4 Emptying Filter Housings

1. Filter housings shall be able to be completely emptied in the event of full cleaning baths (isolating valves).
2. There shall be an emptying means at the lowest point on the dirty side and clean side. Sufficiently dimensioned drain cross sections are to be provided at the filter housings (quick emptying).
3. In order to replace filter elements which are flowed through from the outside to the inside, the housing shall be able to be emptied until the substance is below the element holder (plug-in side). This is to be ensured, since there will otherwise be a very high risk of contaminating the substance's clean side.
4. The housing shall have a ventilation option in order to establish a depressurized condition before opening the filter housing. Automatic ventilation is to be additionally provided at the filter housing.
5. At simple washer systems, the filter ventilation and deaeration can be performed manually by means of a stop cock at the highest point of the filter housing. A vent pipe line with 180° deflection (fluid exit towards the floor) shall be available for this purpose. Sufficient space should be provided to accommodate a collecting tank. The drained fluid shall not be discharged into the floor pan.
6. Escaping liquid shall be avoided when opening the filter cover.
7. Buckets are not permitted for emptying procedures.
8. The emptying concept for filter housings (connections for extraction and pumping units) shall be coordinated with the representative.
9. If compressed air is to be used for emptying, it should be observed that the filter housings may be subject to the Pressure Vessel Code for Gases (Technical Inspection Association acceptance, etc.). Appropriate safety-related precautions are to be taken.

1 5 6 7 9

25.16.5 Filter Replacement

1. A drip option is to be provided for non-regenerable filter substance (bag, candle-type, etc.) at the system. The escaping liquid shall not be discharged into the floor pan. The collected substance shall be able to be emptied into a tank to be provided by the operating company by means of a drain cock.
2. When removing the elements from the element holder, dirt particles may also reach the clean side (fall down). If it cannot be ensured that no dirt ends up on the clean side, the cleaning cycle shall be present. e.g. in the case of bag filters: Soiling not critical –> A rinse cycle is not necessary here. If a rinse cycle is implemented, it must be started in the equipment control automatically in a non-deselectable manner. The liquid used for purging is to be admitted into the dirt container through a purge line. The particles which inadmissibly reach

the clean side are removed from the system behind the filter element by the purging cycle. The supply line to the spray tools is to be closed prior to the filter replacement and during the purging process.
3. Measures are to be taken to rule out inappropriate filter installations (e.g. insertion aid for bag filters).

1 5 6 7 9

25.16.6 Differential Pressure Monitoring

1. A contamination indicator shall be installed in filtration systems.
2. Visual systems without integration in the equipment control (e.g. extendable pin, colored turntable) are only applied in cleaning systems for component parts without particulate residual dirt requirement (DBL 6516.50) or in non-cycle-dependent systems.
3. Electrical differential pressure monitors (differential pressure monitoring with pre-warning) shall be used to clean components with residual dirt requirements. The pre-warning shall be displayed on the control panel. The system is set to "stop after end of cycle" after reaching the permissible differential pressure.
4. The pressure measurement is to be performed immediately upstream and downstream of the filter housing.
5. The differential pressure monitoring shall be dimensioned for a measurement range of approx. 0.2 to 4 bar. The differential pressure evaluation in the equipment control shall be freely parameterizable, depending on the filter substance used.

1 5 6 7 9

25.16.7 Taking Samples

1. Taps are to be applied for the chemical and particulate analyses of the cleaning agents during operation.
2. Pipe stubs welded onto pipes with ball cocks are inappropriate for extracting substances in order to monitor the particulate contamination.
3. Suppliers for qualified sampling components: in the MFL (in the BFS). In production areas with laboratory analyses, the sampling prescribed in the BFS is not required.
4. The sampling points are attached to the system in coordination with the representative.
5. For safety-related reasons, sampling points are permitted only for sampling low-pressure systems.
6. Samples shall not be taken from strands of HP systems under high pressure (behind the HP pump). The applicable safety regulations are to be taken into account.

1 5 6 7

26Chip Conveyors (Chapter in MBN9666)

1 5 6 7

26.1 Discharge Conveyors(Scraper Conveyors)

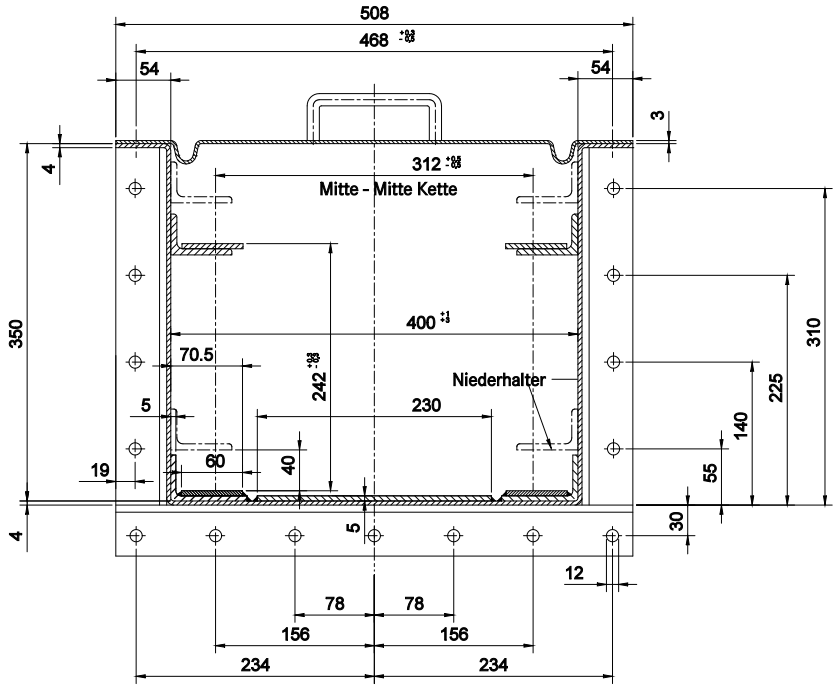
The following specifications shall be implemented on scraper conveyors which are not integrated directly into a system's machine bed.

1 5 6 7

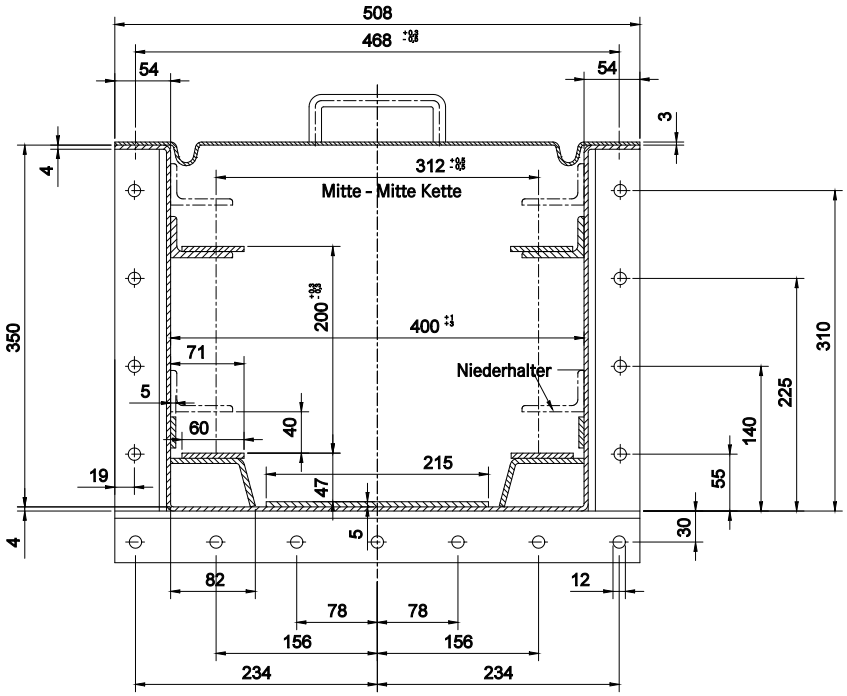
26.1.1 Tray

1. Full wall carrier, see sketches (cross-sections).
2. Completely oil- and emulsion-tight, welded top angle frame.
3. With bolts and round cord or flat seals for both connection sides. Seal manufactured from oil- and emulsion-resistant material.
4. Material St37-2, wall thickness 4 mm.
5. Lateral chain guide rails manufactured from St60, at least 5 mm thick.
6. Wear plate/floor panel, 5 mm thick, at least Creusabro 4800, material number 1.6523, or Hardox 400 or equivalent, weldable and hot-formable material.

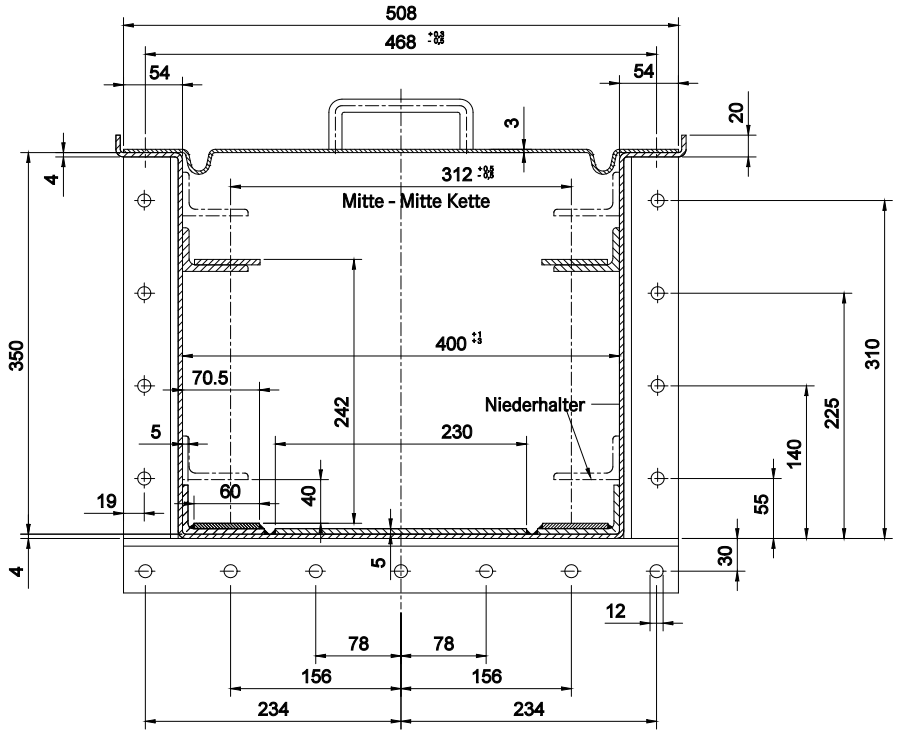
Scraper conveyor cross-section 400 x 350; version A:



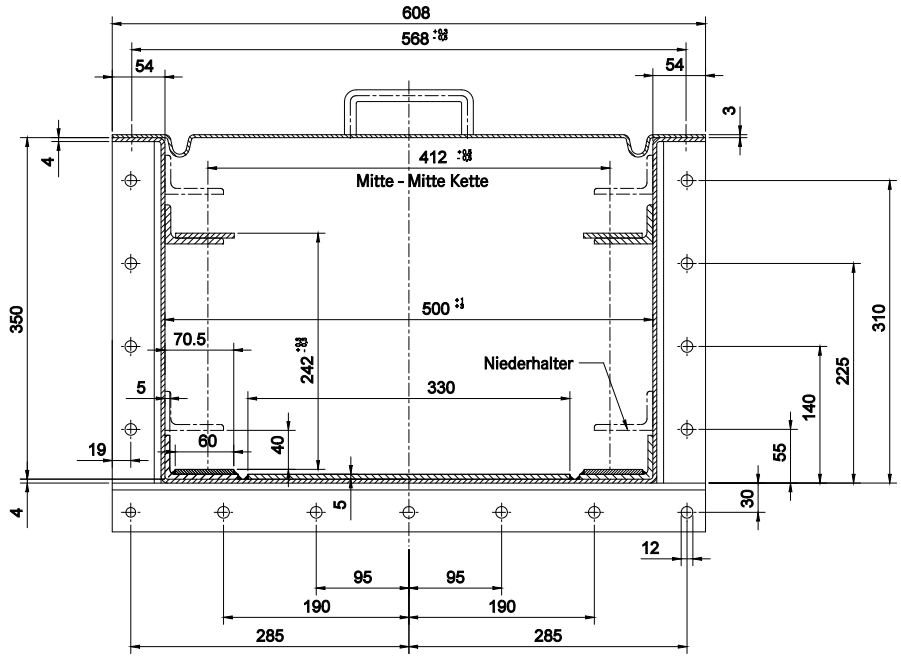
Scraper conveyor cross-section 400 x 350; version B:



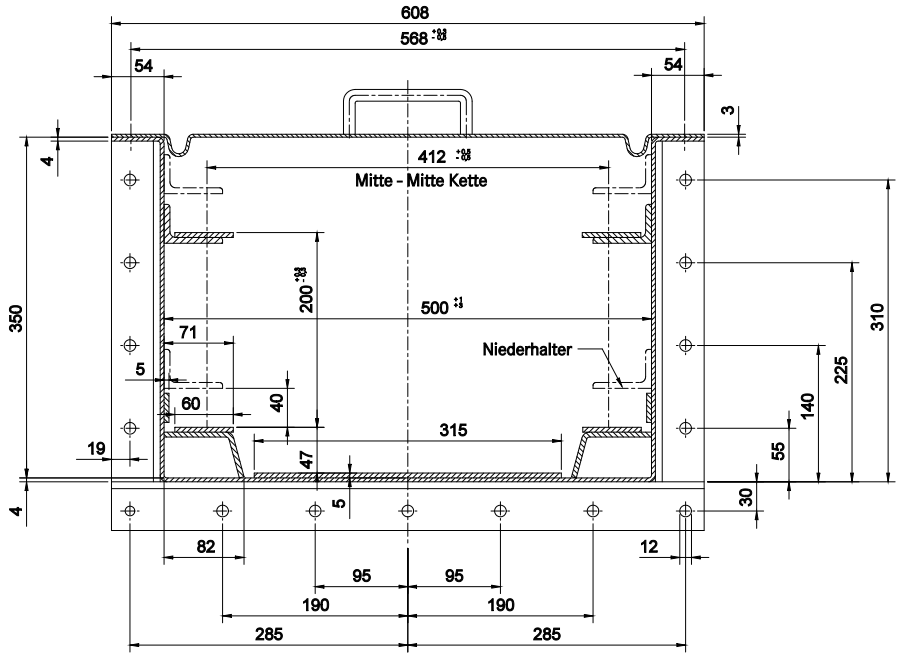
Scraper conveyor cross-section 400 x 350; version C:



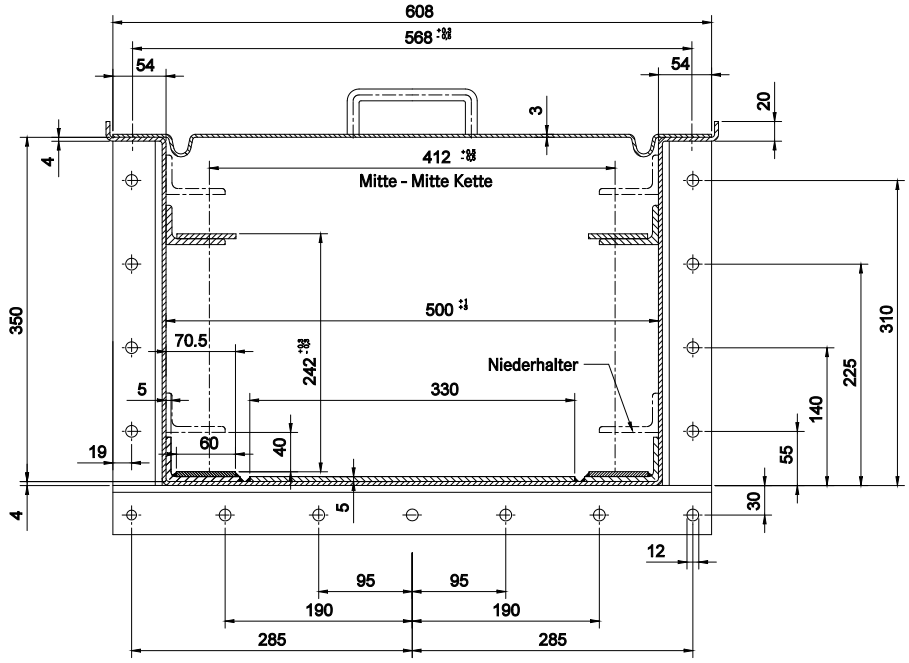
Scraper conveyor cross-section 500 x 350; version A:



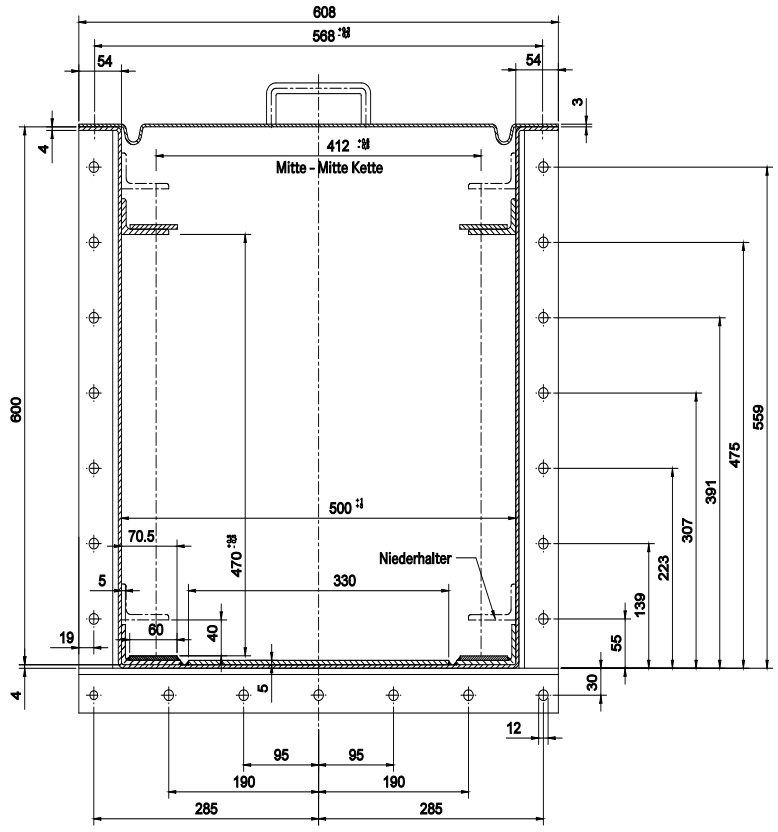
Scraper conveyor cross-section 500 x 350; version B:



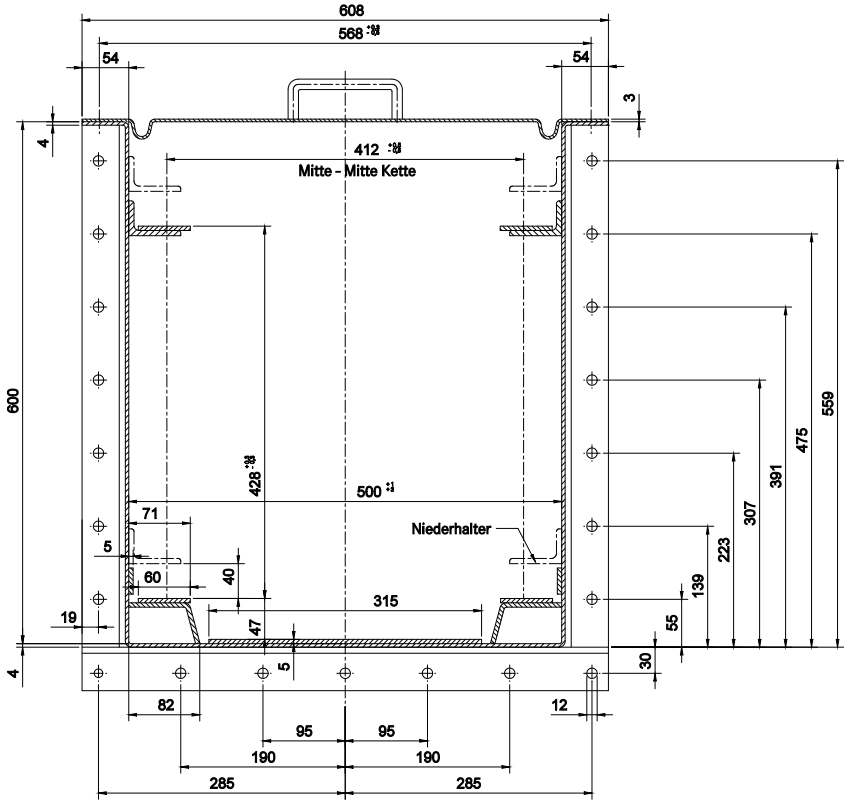
Scraper conveyor cross-section 500 x 350; version C:



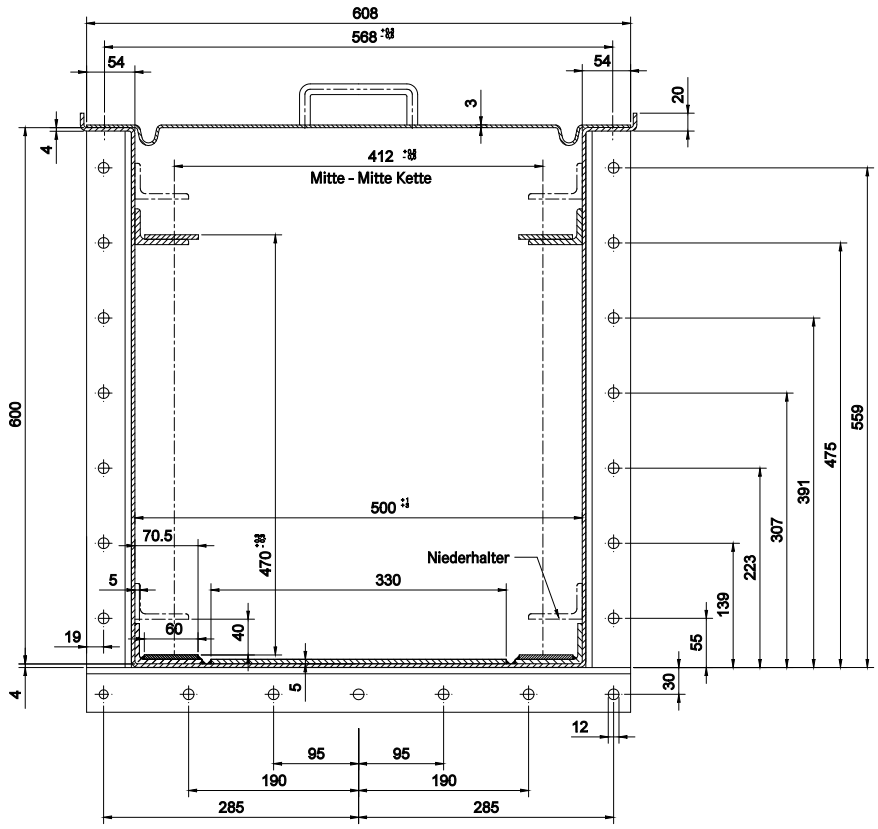
Scraper conveyor cross-section 500 x 600; version A:



Scraper conveyor cross-section 500 x 600; version B:



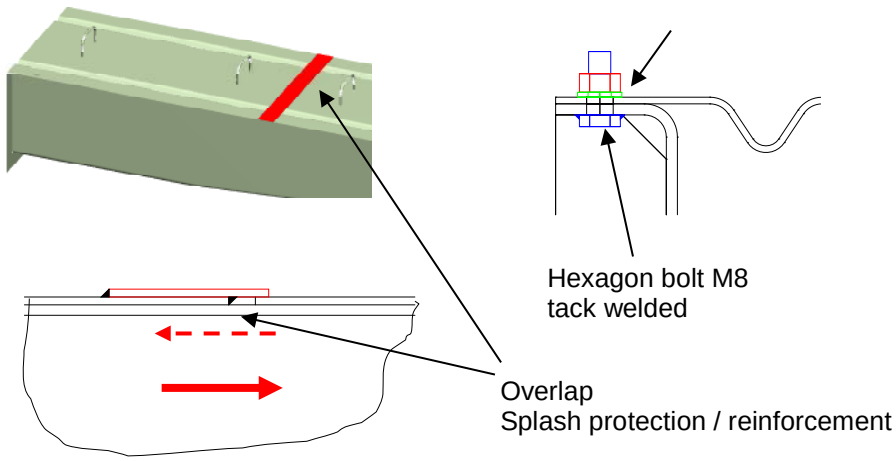
Scraper conveyor cross-section 500 x 600; version C:



1 5 6 7

26.1.2 Cover

1. Tray/conveyor completely covered, cover plate 3 mm thick.
2. Max. length of the individual cover plates 1000 mm, with bead on both sides (drip edge) according to sketch.
3. Each cover plate bolted with 4 hexagon bolts M8; the bolts are bolted to the tray. The bolt holes in the cover plate shall be designed as elongated holes measuring 15 mm.
4. The cover plates shall overlap, see sketch.
5. 2 grips per cover plate.



1 5 6 7

26.1.3 Inspection Flap

1. Ascending conveyors are provided with a hinged flap at viewing height to monitor the running function.
2. In accordance with the accident prevention regulations, the flap shall be secured by locking with a square lock (spring lock).

1 5 6 7

26.1.4 Ascending and Descending Arcs

1 5 6 7

26.1.4.1 Arc Tray

1. See tray description for design.
2. Standard angles are 15°, 30°, 45° and 60°.
3. Plant 030 in Gaggenau, only 45° for slat-band chain conveyors. X

1 5 6 7

26.1.4.2 Chain Holding-down Device

1. Lateral chain guide rails made of St60, at least 5 mm thick.
2. The chain guides are to be screwed, however through-bores are not permissible.

1 5 6 7

26.1.4.3 Cover

See tray description for design.

1 5 6 7

26.1.4.4 Inspection Flap

1. If required, the arc section is provided with an inspection flap.
2. In accordance with the accident prevention regulations, the flap shall be secured with hinges and by locking with a square lock (spring lock).

1 5 6 7

26.1.5 Drive Station

1 5 6 7

26.1.5.1 Housing

1. Full wall girder segments shall not be longer than 1,500 mm.
2. Top angle frame with detachable transfer cover (dry conveyor) or detachable front plate (wet conveyor).
3. See tray description for design.

1 5 6 7

26.1.5.2 Cover

See tray description for design.

1 5 6 7

26.1.5.3 Drive

1 5 6 7

26.1.5.4 Chain Holding-down Device

1. See tray or ascending and descending arc description for design.
2. Lateral chain guide rails manufactured from St60, at least 5 mm thick.
3. The following applies to Plants 010 Untertürkheim, 040 Berlin and 068 Hamburg: A E F
   The chain guides are bolted and must be sealed with metal seals at the outer sides.
4. The following applies to Plants 030/034 Gaggenau, 020 Mannheim and 069 Kassel: X Y Z
   The chain holding-down devices shall be welded.

1 5 6 7

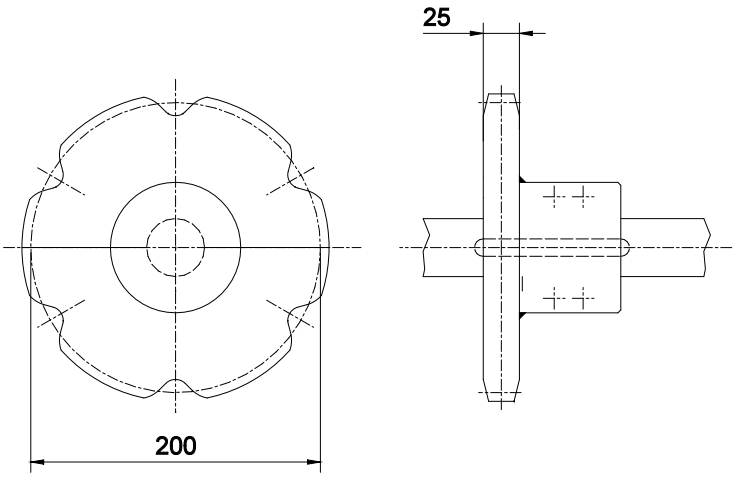
26.1.5.5 Inspection Flap

1. Per transfer point (conveyor to conveyor), one flap with hinges for monitoring/maintenance.
2. In accordance with the accident prevention regulations, the flap shall be secured by locking with a square lock (spring lock).

1 5 6 7

26.1.5.6 Chain Gears

1. The teeth shall be designed with hardened flanks.
2. The gears are secured on the shaft with a groove and spring.
3. Split gears shall be used.
4. Gears shall be manufactured from C45 material.



1 5 6 7

26.1.5.7 Drive Shaft Mounting

1. Drive shaft diameter at least 40 mm.
2. Bearing manufacturer: The component parts can be found in the material approval lists (in BFS).
3. Design: Enclosed bearings with permanent lubrication (maintenance-free) with sheet steel sealing cap.
4. With dry conveyors: External, cast, vertical roller bearing or quadratic, flanged roller bearing.
5. With wet conveyors: External, cast, quadratic, flanged roller bearing with leak pockets for returning the escaping conveying medium.
6. Removal of the shaft upwards and forwards shall be possible, i.e. assembly slots in the side walls, or removable cover (transfer cover).

1 5 6 7

26.1.6 Drive Motor

1 5 6 7

26.1.6.1 Plug-in Gear Motor

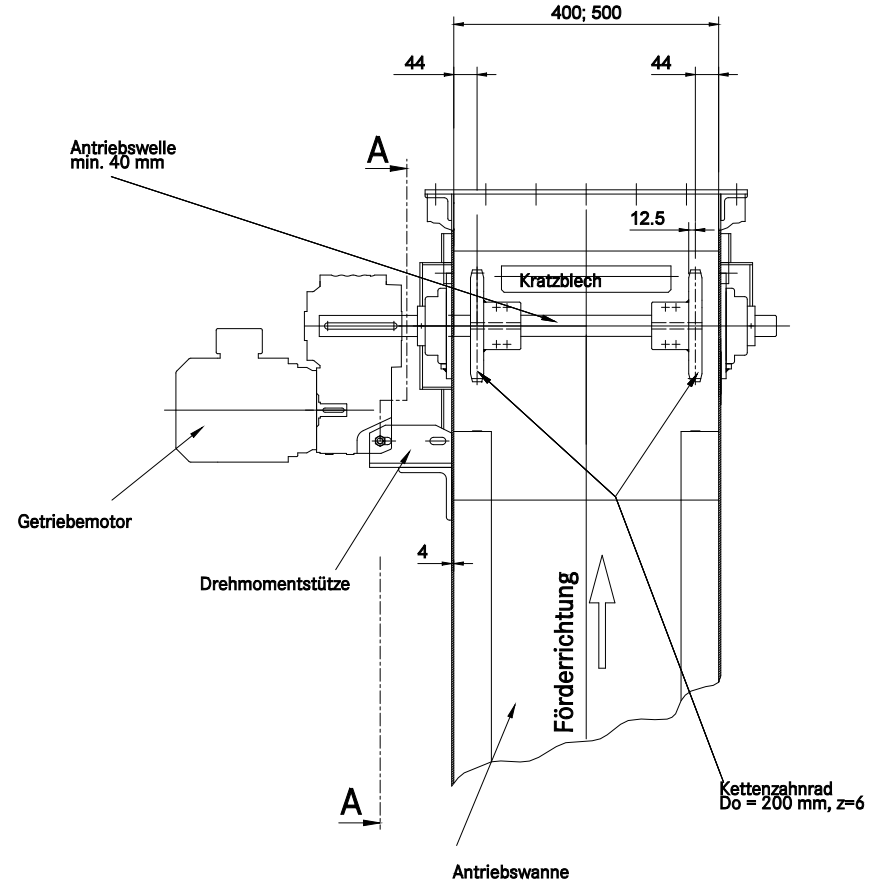
1. Standard design as a spur gear flat gear motor.
2. In special cases, as a tapered or worm gear motor.
3. When designing the motor output, max. chip uptake shall be anticipated, i.e. chips incurred along the entire length incl. swan neck.
4. Makes: The component parts can be found in the MFL (in BFS).

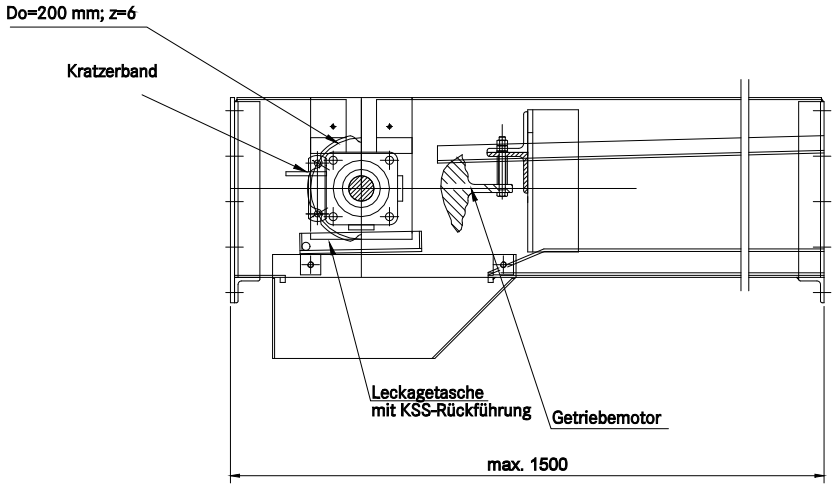
1 5 6 7

26.1.6.2 Motor Load Monitor

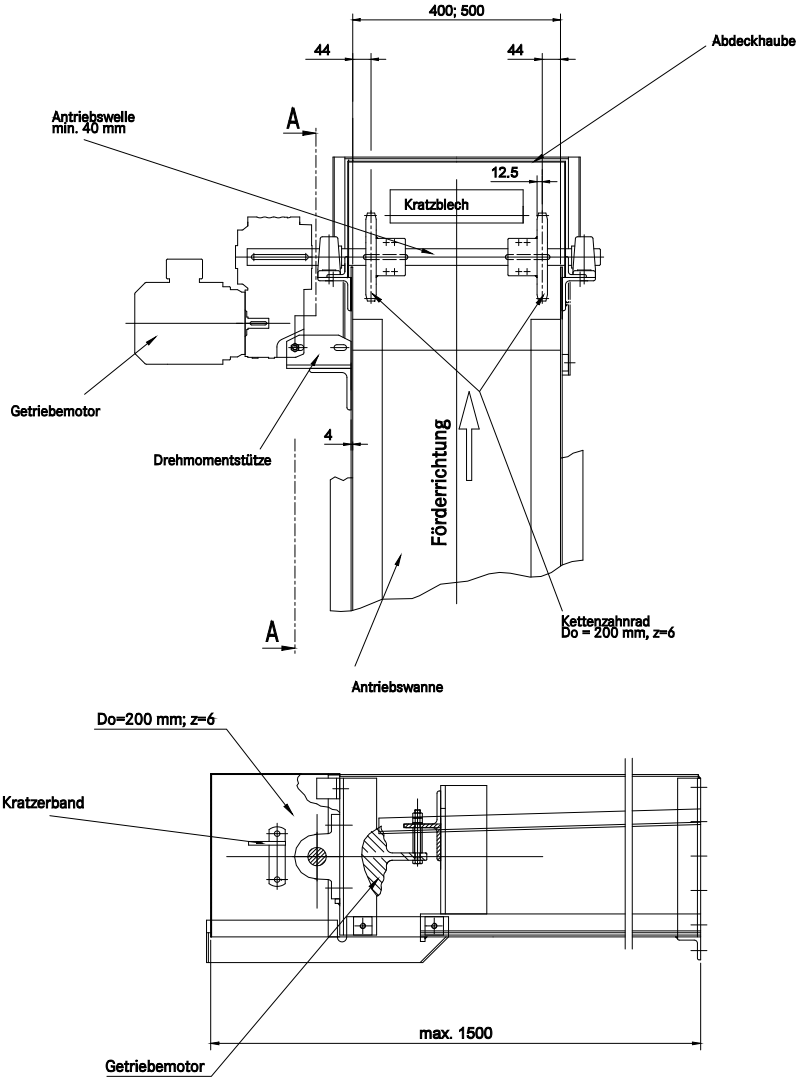
1. The motors shall be selected in such a way that they can be installed by Daimler with an additional motor load monitor, for motor protection switch and torque monitoring, with the option of setting the upper and lower limits.
2. See Powertrain Requirement Specifications, Part III – Electrical Components and Approval List in the Material Data Manager (BFS; www.materialdatenmanager.de).
3. The conveyor function of the chain shall be monitored directly (not at the drive shaft).

Drive station with flanged bearing:





Drive station with pedestal bearing:



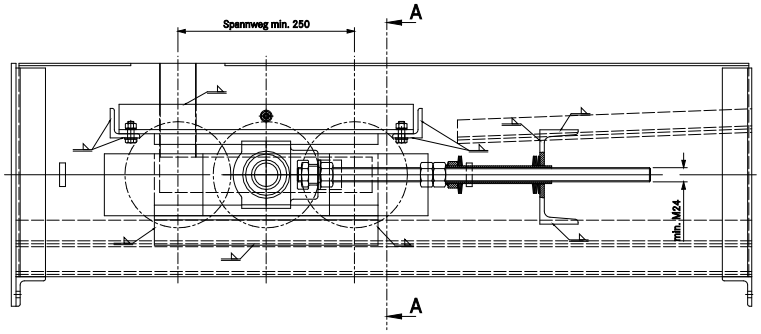
1	5	6 7

26.1.7 Relay Clamping Station

1	5	6 7

26.1.7.1 Tray

1. Relay tray as full wall carrier, max. 1500 mm long, with top angle frame and detachable front plate.
2. See tray description for design.
3. Drain connection DN50 with ball cock.



1 5 6 7

26.1.7.2 Cover

See tray description for design.

1 5 6 7

26.1.7.3 Chain Relay Pulleys

1. Flank-hardened disk wheels shall be used.
2. Split disk wheels shall be used.
3. Outer disk diameter 200 mm.
4. Disk wheels with threaded pin M8 with journal according to DIN 915 for securing on the axis.
5. Material C45

1 5 6 7

26.1.7.4 Relay Axis Mounting

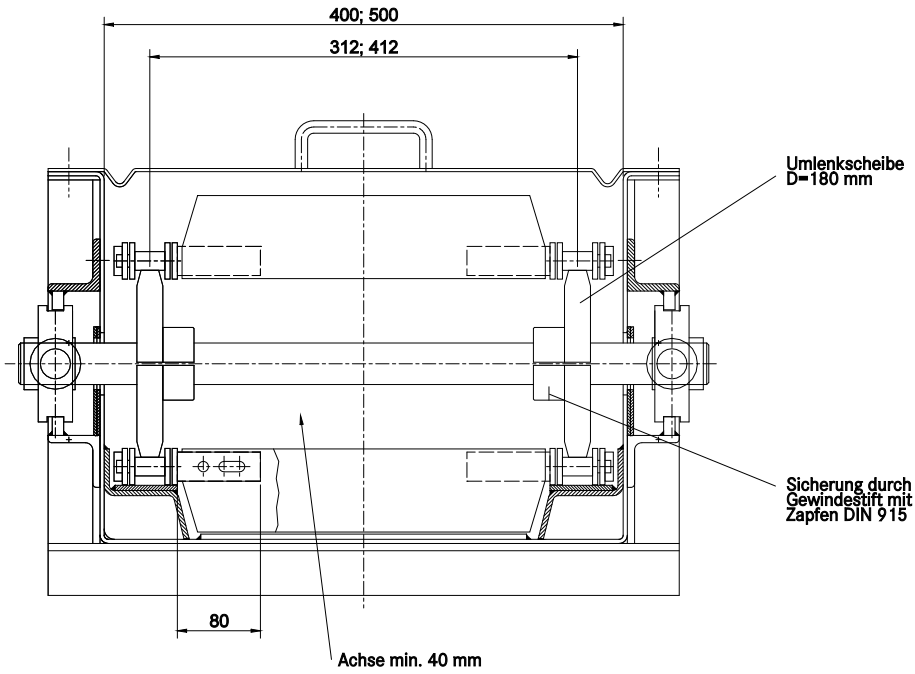
1. Relay axis diameter at least 40 mm.
2. Outer clamping device with clamping spindle on both sides at least M24 and spring assembly, clamping travel at least 2.5 x chain pitch.
3. Bolted guide construction with constantly closed clamping groove.
4. Bearing manufacturer: The component parts can be found in the material approval lists (in BFS).
5. Design: Enclosed bearings with permanent lubrication (maintenance-free) with sheet steel sealing cap.
6. The axis shall be removable upwards, i.e. assembly slots in the side walls.
7. Wet conveyor with water/oil chamber on both sides and one drain connection DN50 with ball valve per chamber.
8. Chamber clearance at least 250 mm.

1 5 6 7

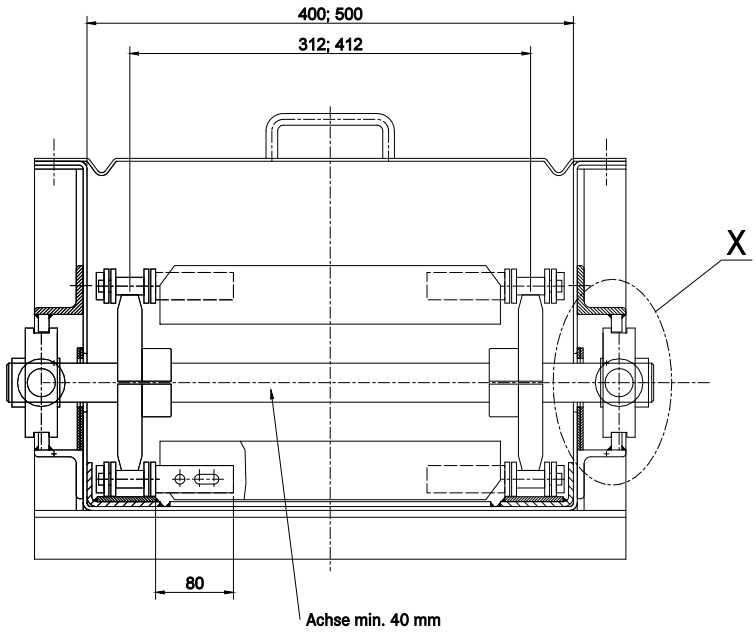
26.1.7.5 Chain Holding-down Device

See ascending and descending arc description for design.

Relay clamping station with chain positioned above:



Relay clamping station with chain positioned below:

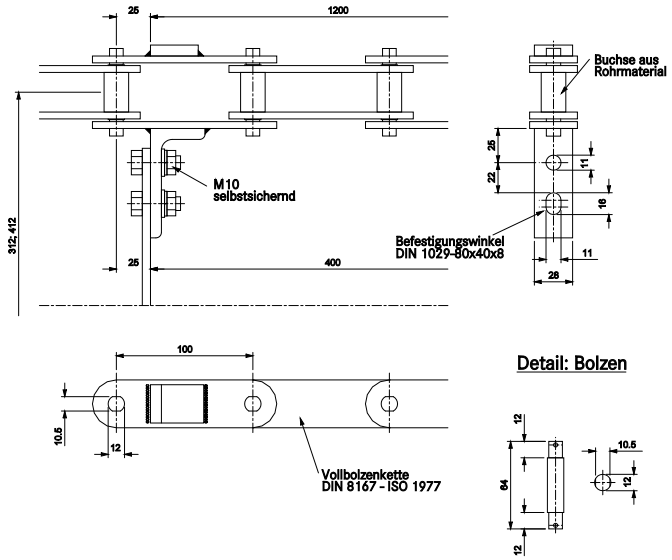


1 5 6 7

26.1.8 Double-Strand Full-Bolt Chain, Standard

Conveyor chain:

1. Solid-bolt chain according to DIN 8167 – M80.0.100 (100 mm graduation), C45 chain material.
2. Scraper plate heights: 50 mm, 60 mm or 80 mm.
3. Distance between scraper plates, standard 400 mm (max. 600 mm).
4. Link plate connection spliced on both sides.
5. Outer links are provided with sliding blocks (every 12th division) as impact protection (chain against tray).
6. Scraper plate fastening angle manufactured from St37. These are welded onto the inner outer link. See sketch or Daimler drawing (chain for scraper conveyor M80-100).
7. Each scraper plate is secured with 4 bolts M10 with self-locking nuts.
8. For better reinstallation in the event of a repair, a through-bore designed as an elongated hole shall be implemented on each support bracket on both sides, see Daimler drawing (chain for scraper conveyor M80-100).



1 5 6 7

26.1.9 Chain Tube For Upper and Lower Chain Cover

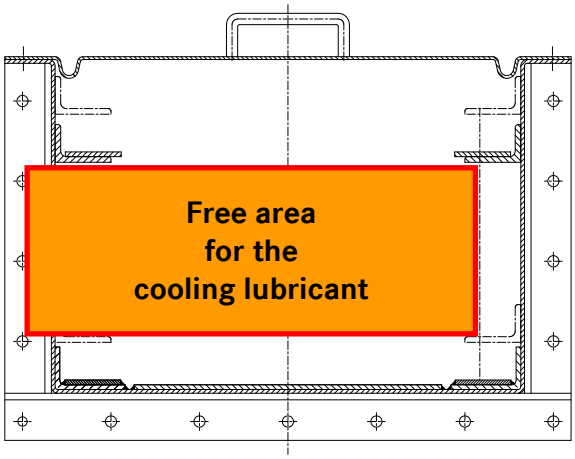
1. Per chip collection point, one set (2 x upper strand and 2 x lower strand) of chain tubes, each 1,000 mm long.
2. The material Creusabro 4800, material number 1.6523 or Hardox 400, or equivalent weldable and hot-formable material shall be used in the machine tool. Sheet thickness of 3 mm.
3. The following applies to Plants 010 Untertürkheim, 040 Berlin and 068 Hamburg: A E F
    a. Attachable with 4 bolts each, at least M8.
    b. The chain covers and bolts are enclosed loose and adapted during assembly.
    c. The threaded connections shall be sealed to the outer sides with metal seals.
    d. Silicone sealing material is not permissible.
4. The following applies to Plants 030/034 Gaggenau, 020 Mannheim and 069 Kassel: X Y Z
    a. The chain covers shall be welded.

1 5 6 7

26.1.10 Cooling Lubricant Drain/Flow Rate (Emulsion/Oil Drain)

The flow rates apply at room temperature in the area of the marked, free area, under consideration of wave formation even if the conveyor is installed without slope.
Only 80% of the available free space for cooling lubricant may be used.

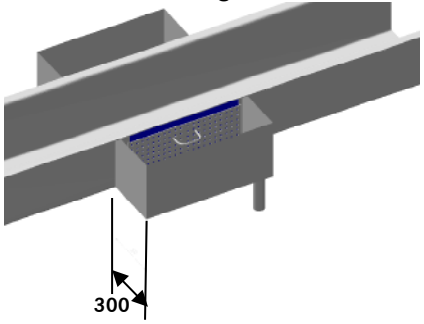
- 0.7 m/s for emulsion
- 0.3 m/s for an oil from 6 to 15 cSt (40°C)
- 0.2 m/s for an oil > 15 cSt

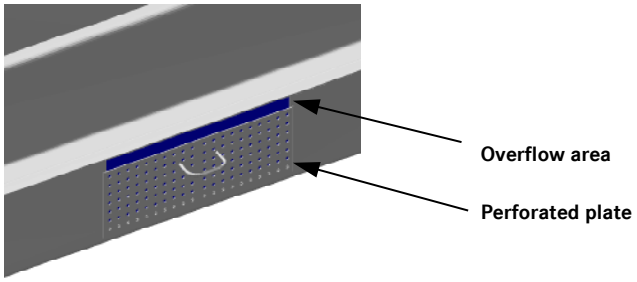


1 5 6 7

26.1.11 Lateral Drain

1. Lateral drain as required.
2. It shall be possible to remove the pluggable perforated plate.
3. Maximum hole diameter in the perforated plate 10 mm.
4. Free overflow areas/cross-sections above the perforated plate. Overflow layout/rate 0.5 m/s.
5. Drain box clearance at least 300 mm.
6. No machine discharge shall be installed in the area above the drain section.





1 5 6 7

26.1.12 Ceiling Passage

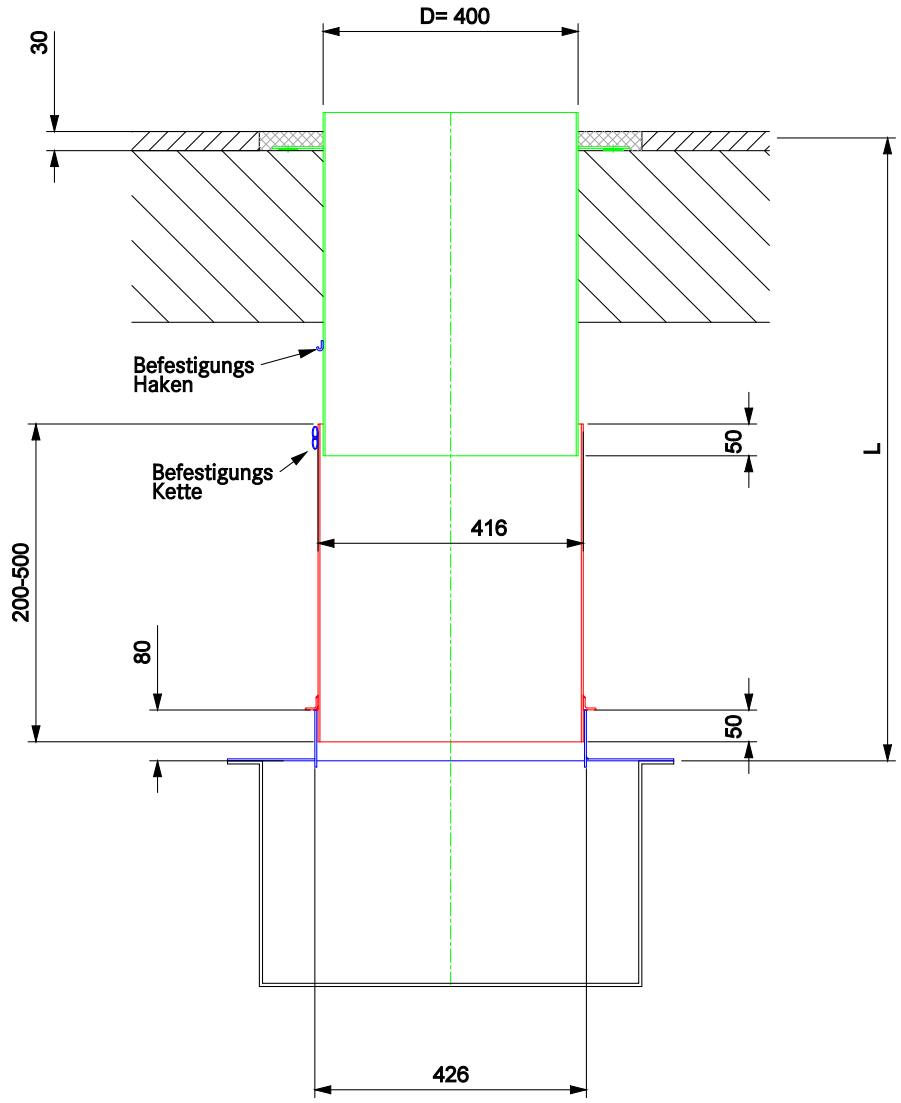
1. The ceiling passage/ceiling sleeve shall be adapted to the local circumstances.
2. Wall thickness at least 3 mm.
3. See sketch and Appendices 11.4, 11.5 and 11.6 (ceiling passage for chip discharge).

1 5 6 7

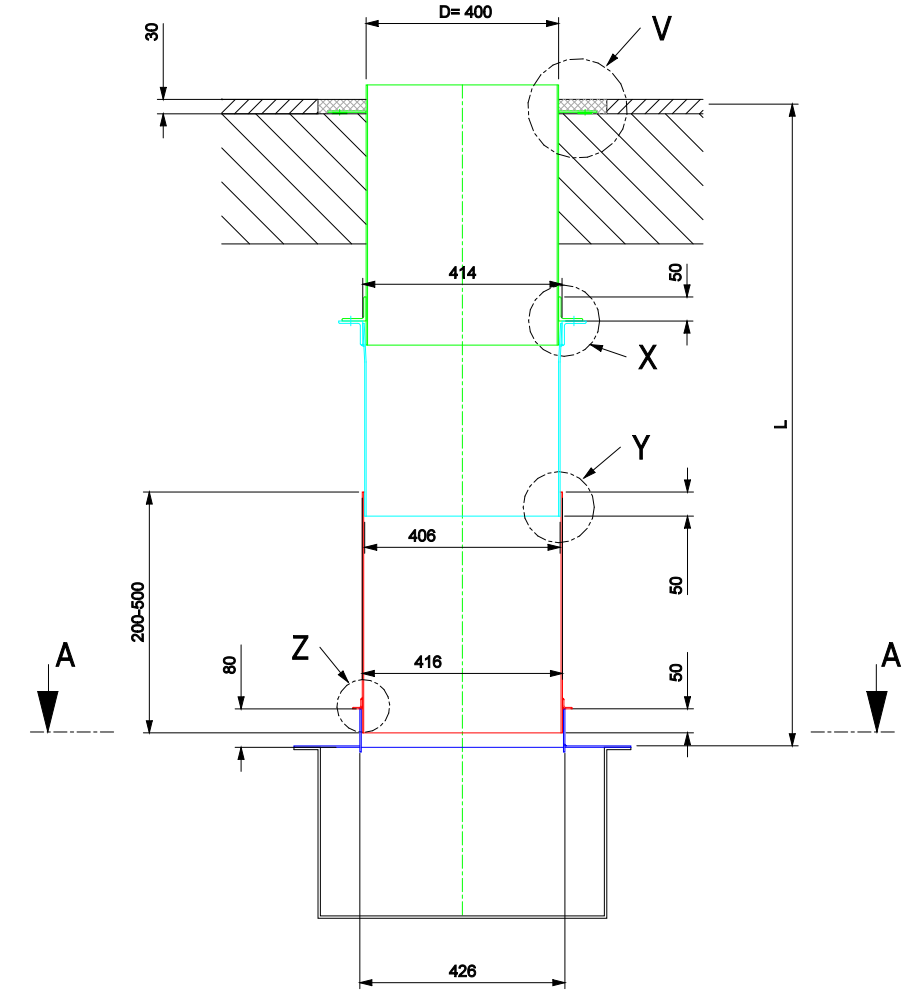
26.1.13 Chip Discharge

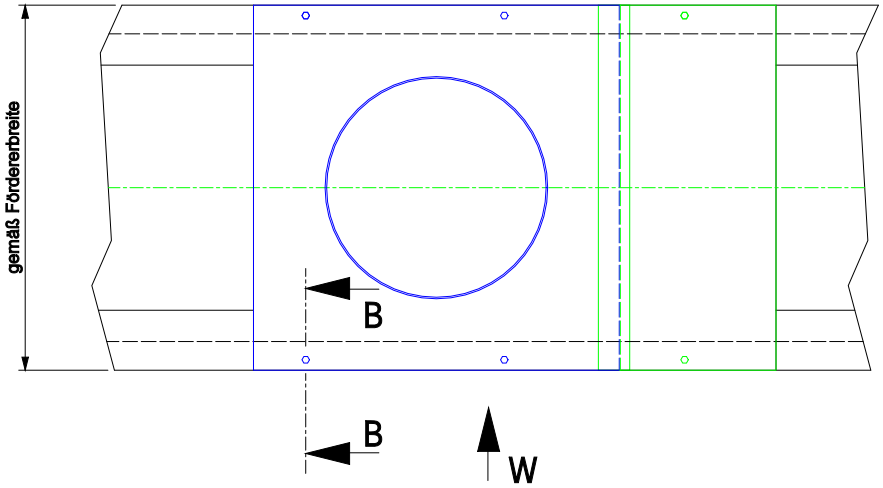
1. Version: see sketches and Appendices 11.4 and 11.5.
2. The chip discharge is bolted to the ceiling sleeve/lining pipe with at least three M10 bolts,
3. In the case of long chip discharges (greater than 1,000 mm), the length shall be subdivided over several boltable chip chutes (max. length 1,000 mm per chute).
4. At a suitable point, chip discharges are provided with a flap with hinges or a sliding sleeve.
5. In accordance with the accident prevention regulations, the flap shall be secured by locking with a square lock.

Chip Discharge, Short Version:

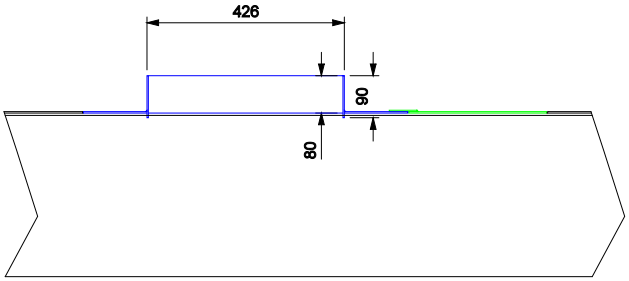


Chip Discharge, Long Version, with Intermediate Sleeve:





View 'W'



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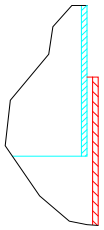

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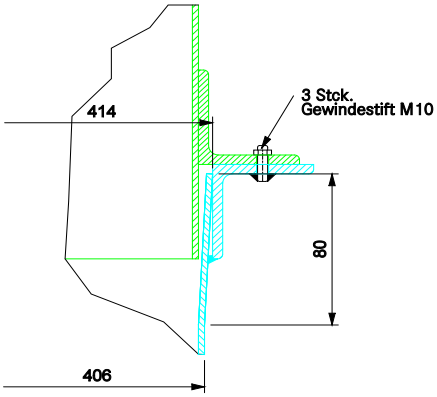

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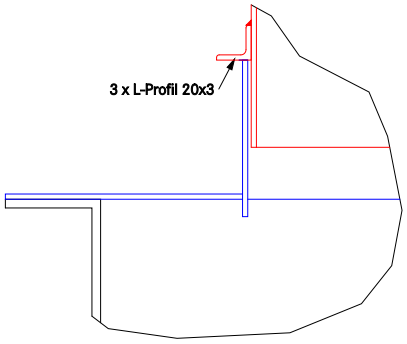

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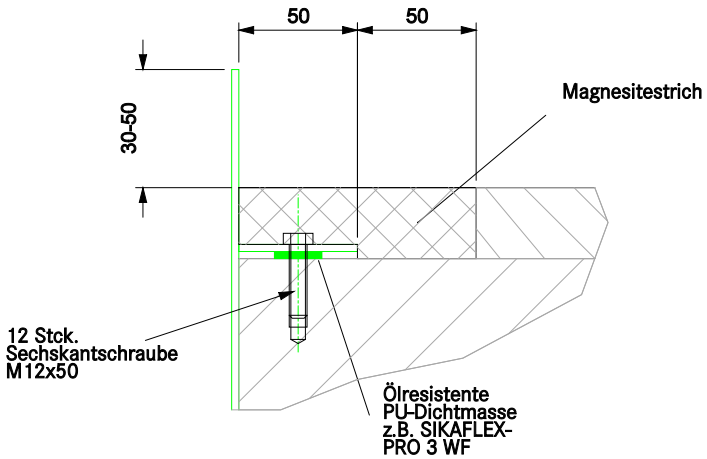

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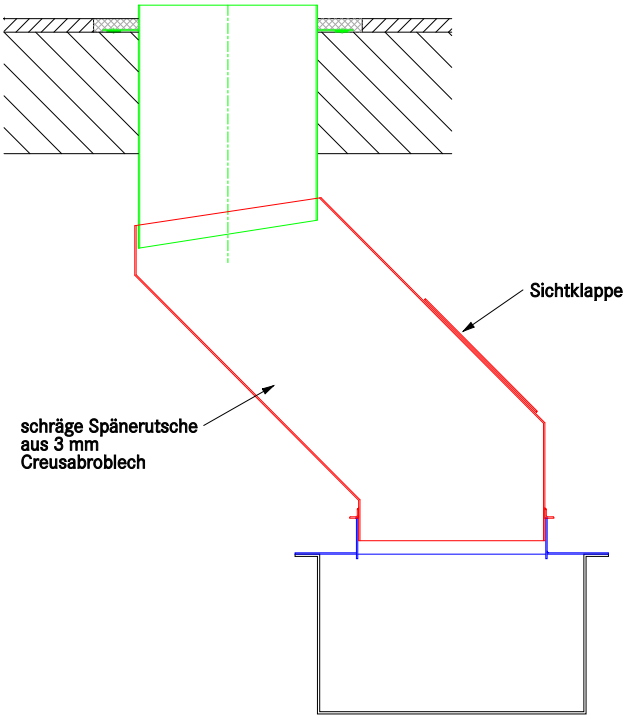
26.1.14 Chip Discharge, Inclined Design

1. The chip discharge shall be adapted to the local circumstances.
2. Wall thickness at least 3 mm.
3. Material: Creusabro 4800, material number 1.6523 or Hardox 400, or equivalent weldable and hot-formable material.
4. At a suitable point, chip discharges are provided with a flap with hinges.
5. In accordance with the accident prevention regulations, the flap shall be secured by locking with a square lock.
6. The chip discharge shall be ensured.



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26.1.15 Suspension

Fastening:	Clamped or bolted
Height adjustment via:	Threaded spindles
Threaded spindles:	At least M20
Profiled steel:	At least L60
Height adjustment:	At least 200 mm

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27Energy Management Chains (Chapter in MBN9666-2)

Note: This chapter is included in Powertrain Requirement Specifications, Part III "Electrical Components, Control Technology and Production-Oriented IT Systems".

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Manufacturer, types and parts shall be used as per MBN9666, approval of procurement source.
Strain-relief clamps: The component parts can be found in the MFL (in BFS).

28 Energy Supply: Compressed Air, Coolant and Heat Supply

28.1 Compressed Air Supply

For compressed air supply to all machines and tools, the parameters as per Appendix 14 apply

28.2 Cooling Water Supply – Technical Data

The technical data appear in Appendix 14. Generally the technical data shall be coordinated with the representative.

28.3 Heat Supply

28.3.1 Technical Parameters

The parameters as per Appendix 14 shall be complied with when designing heat exchangers for washing machines, etc.:

28.3.2 Heat Cycle Requirement Profile (Process Heat/Thermal Heat)

1. The design pressure and design temperature required for the material shall be requested in writing with the representative in consultation with the department responsible for the heat supply at the respective plant.
2. The connection flanges are to be designed in accordance with DIN 2633.
3. Several heat exchangers are to be connected with piping for the production equipment to allow one central connection point to be created for each production equipment unit.
   The following applies to MO:
4. The heat exchanger is controlled and the isolating valves and measurement and control fittings are to be designed according to DIN 4747-1, Figure 5. The scope illustrated in this figure is to be implemented comprehensively by the production equipment supplier. Not applicable for connection to production equipment: Energy meter / ambient temperature sensor
5. Heat exchangers are only permitted in "galvanized steel" or "stainless steel". "Copper" or other non-ferrous metals are not permitted as the heat exchanger material.
6. The heat consumer controller is to be designed in such a manner to keep the return flow temperatures permanently below 70°C.

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29 Cooling of Machines and Switch Cabinets

Large-scale systems and combination networks shall receive priority.
No more decentralized small systems should be brought into the factory.
High temperature levels for reducing operating costs shall be chosen.

The Untertürkheim plant should have a maximum of 3 temperature levels in the building / plant.
30°/35° Return coolant from cooling towers on the roof
16°/22° Cold water (refrigerating unit with refrigerant)
6°/12° Cold water (refrigerating unit with refrigerant)

Refrigerating units shall enter circulation only if legally compliant:
Compliance with German Health & Safety at Work Regulations (BetrSichV); AwSV; DIN EN 378; CE conformity shall obtain, Pressure Equipment Directive shall be complied with; Directive (EU) No. 517/2014 on fluorinated greenhouse gases shall be considered.

Given the Directive, refrigerants with a GWP less than 10 shall be preferred. Test cycles as well as effects shall be considered in the risk assessment! Refrigerants shall be approved via environmental and work protection.

A consequence is the obligatory of an operating manual, an inspection as per DGRL before commissioning. Refrigeration systems require repeated inspections and must be reported to the specialist unit.

29.1 Cooling in General

1. The type of cooling:
   a. heat dissipation to cooling water (open circuit system)
   b. heat dissipation to central cold water reservoir by way of heat exchanger in a closed system (central cooling equipment)
   c. heat dissipation to workshop air (only with written approval)
   d. Connecting refrigerating units to a cold water grid is prohibited! (In case of wrong delivery, machine must be converted for heat exchanger, if cold water grid is available)
   e. If a refrigerating unit (including control system) must be procured, it shall be connected to the machine so that the machine at any time can be reconnected to a cold water grid (without much labor / standalone devices).

   To be coordinated with the representative.
2. The technical boundary conditions for supplying cooling water to the cooling units shall be taken from the plant-specific specifications. (see Chapter 28.2 and Appendix 14). Detailed design parameters shall be coordinated with the representative (in MO: CC/TSEVM)
3. The ambient temperature can reach 45–65°C, depending on the installation location (to be coordinated with the representative).
4. Applies to the machine coolant circuit: The machine manufacturer shall internally, up to the interface, use the stainless-steel threaded connections in accordance with DIN EN ISO 8434-1 (the component parts can be found in the MFL (in the BFS)) and stainless-steel pipes (material nos. 1.4301, 1.4571, 1.4404, AISI316L). In the secondary circuit, the specified stainless steel pipes can be replaced by other suitable materials (e.g. plastic) if necessary (e.g. for closed circuits / machine circuits, see also Appendix 06: Cooling) after written agreement with the representative. Any use of aluminum materials with surfaces touching water in the cooling circuit is not permissible. Line extensions may also be pinched by written agreement with the representative; a threaded connection shall also be provided upstream from exchangeable components.
5. The machine and switch cabinet cooling shall be designed in accordance with Appendices 6.0 and 6.1. The approved component parts in the approval list in the material data manager (BFS component approval system) shall be used.
6. Piping for heat exchangers and chiller units shall provide a central connection point for cooling water, cooling lubricant, washing water and compressed air for each machine (installation).
7. Internally, the machine supplier shall design the system such that its piping is completely self-contained (including the cooling water cooling water regulator) (see Appendix 6.0; note interface).
8. The heat exchangers for cooling water, cold water reservoir and block cooling units shall be made of stainless steel (welded or bolted, not soldered) and equipped with regulation systems.
9. Specific design regulations for motor spindles and linear motors shall be observed.
10. Coolant circuit and temperature monitoring of the motor spindles as per MBN 9666-2.
11. The cooling water circuit shall be interrupted when the system is switched off.
12. Once-through cooling is not permissible.
13. If corrosion and antifreeze is required, Glysantin G40 shall be used.
14. Adjustment/throttling of individual legs by means of ball valves is not permitted. The flow shall be controlled for each consumer.
15. The ball valves shall be accessible from the shop floor and may be installed at the boundary of supply at a maximum height of 2.2 m.

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29.2 Small Chiller Units for Machine Cooling (Spindles, Motors, Hydraulics, etc.)

Machines shall be constructed with heat exchangers so as to allow connection to a central cold water grid. If no cold water grid is available and coolant is not sufficient, as many machines shall be interconnected as possible. Central refrigeration for the line / shop floor or building shall be planned.

Central and peripheral cooling supply options shall be listed in the bid.

Design of small chiller units:

they shall be connected to the coolant.

If machines with small chiller units are used, however, the design/configuration and mounting/removal shall be coordinated with the representative. The following must be complied with:

1. Chiller units with a cooling performance of up to 20 kW shall be single-circuit units, and from 20 kW to around 100 kW, two-circuit units. Max. 2 compressors per refrigeration system (schematics: see Appendices 8.2 to 8.4).
2. Refrigerant shall be sustainable for the future. GWP less than 10 if possible. All other refrigerants shall be used only with the express approval of the representative. Refrigerant shall be approved by the representative for environmental and work protection. SigmaDX
3. The refrigeration system is connected as per Appendices 8.2 to 8.4.
4. Preferred are stand-alone units, possibly for supplying several consumers (machines, installations).
5. Should this not be possible, chiller units installed in the machine shall be easily accessible so they can be replaced by a fitter within 60 minutes.
6. For heat dissipation (condenser) only cooling water shall be used, cooling water connection outside of the machine, with vibration decoupling, as shown in Appendix 6, is part of the scope of delivery.
8. A draining and filling possibility, also for the brine, shall be readily accessible from outside the machine. The brine filling level shall be visible from outside.
9. Coolant temperatures: t_F 35 and t_R 40°C (applies only to chiller units)
10. Service connections for HP and LP sides: 7/16"
11. The units shall be enclosed, so there will be no ingress of dirt by way of open systems and tanks.
12. The brine tank shall be equipped with a venting filter, as for hydraulic systems.
13. The brine tank shall have an adequately sized opening for maintenance, primarily cleaning.
14. The cooling circuit shall be readily accessible for maintenance outside the hazard zone, with protective housing.
15. If deionized (DI) water is used as brine, the brine tank shall be made of stainless steel (not plastic).
16. Cooling water flow rate shall be adapted to the cooling output (regulation).

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29.3 Switch Cabinet Cooling with Primary Water Circuit

1. For switch cabinet cooling, devices and approved component parts from the approval list in the material data manager (BFS; www.materialdatenmanager.de) shall be used.
2. The flow of cold air through the switching cabinet shall be so guided that heat is dissipated as needed.
3. If a direct connection to the shop network is established, the components described in Appendices 6.1 and 6.2 are mandatory.
4. The condensate connection shall be by means of hoses into a transparent tank.
7. Switch cabinet cooling system as a roof-mounted or internal construction is not permissible. Approval by representative only.

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29.4 Antifreeze and Corrosion Protection for Small Chiller Units and Heat Exchangers (Brine). *

*) with the exception of laser and welding equipment

For future projects, GLYSANTIN G40 from BASF is stipulated. The use of other corrosion protection agents is permitted only with the written approval of the representative.

The following shall be observed without fail:

1. If systems that were previously operated with other agents are converted to G40, they shall be thoroughly flushed.
2. For optimum corrosion protection, the proportion of G40 shall be at least 35%. Even with 20% glycol, there is virtually no danger of fungal or bacterial infection.
3. Prior to filling into the cooling circuit, G40 shall be mixed with water at a concentration of greater than 35%. Water quality must correspond to data sheet
4. At regular intervals of once per year or when topping up the coolant, the concentration of G40 in % and the pH (7.1–7.3) shall be checked, otherwise there is a danger of corrosion. Clean and not very hard water shall be used for making up the coolant. Its analysis may not exceed the following limits:

Water hardness: 0 to 20° dGH (0-3.6 mmol/l)
Chloride content: max. 100 ppm
Sulfate content: max. 100 ppm
If the water analysis values exceed the permitted limits, the water shall be treated suitably e.g. by adding soft, distilled, or fully desalinated (de-ionized) water.

5. As far as possible, galvanized component elements shall be avoided.
6. For machines which are still within the warranty period, the substance in use shall not be changed without the approval of the machine supplier.
7. The antifreeze products G40 with suffixes such as 24, 92, etc. are identical (except for their color) and can be mixed (e.g. antifreeze G40 – 24).

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~~29.5~~ Insulation of Cold Surfaces

Cold surfaces on which condensation may form from the humidity of the inside air are to be insulated. These are usually lines/hoses (from transfer point) and condensers which carry cold water generated in a chiller unit. Fittings are to be insulated with reusable collars. Lines for circulating water do not require any insulation, since there is no risk of condensation. The insulation is to be diffusion-proof.

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30 Conditions of Supply for Cooling Lubricant and Water Pumps

Terms of Delivery and Approval List, see Requirement Specifications Appendix 17
Use of the pumps regarding manufacturer, type and version shall be coordinated with the representative (the component parts can be found in the MFL (in BFS)).
The approval form for the use of pumps (template: Form 01 – Special Approval of Pumps) as well as data sheets and drawings shall be submitted for approval. The signed approval form shall be integrated in the system documentation and shall be included with the component part approval on the BFS system.

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31 Process and Environmental Technology Systems

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31.1 General

A conformity evaluation in accordance with the currently applicable machine directive shall be performed. (Conversions shall also be evaluated and documented accordingly.)
The installation engineer shall provide evidence that their specialized company complies with the Water Resources Act (WHG).

When the system(s) are planned and designed, the state of the art at the time the system is commissioned shall be ensured, and Daimler-specific guidelines shall be observed:
MBN 9666 including the BFS
AwSV, WHG
Cooling lubricant and chip systems shall be planned and designed to be energy-efficient. This includes, for example, ensuring that the (system) pumps can be switched on and off according to consumption levels. Also other components that are not continuously needed shall be switched on and off on an as-needed basis.

All solid discharges (chips and sludge) shall be combined on a side area of the system so that chip containers/wagons can be set up safely and in a manner that conserves space. It shall be ensured that the chip containers/wagons can be exchanged/handled (especially in terms of head clearance) safely and efficiently. The concept for exchanging the chip containers/wagons – including in the event of an emergency discharge – shall be presented.

The entire system shall be easy to maintain and repair. It shall be ensured that the system components are safe in terms of accessibility, ergonomics and operation. Suitable platforms and bases with railing shall also be supplied. Maintenance-relevant parts such as chain tensioning devices shall be installed such that they can be operated without having to empty the system. A protection concept shall be presented for freely accessible moving system parts (e.g. take-up spools, filter belts).

Systems for operation with water-mixed cooling lubricants shall be designed such that weekend operation with a freely selectable, in-system circulation is ensured (bath care).

31.2 System Component Cooling Lubricant Central Lines

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The internal piping of the central system and the valves used there shall be implemented as greater than or equal to PN10.

31.2.1 Cooling Lubricant Containers

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The following always applies to all containers containing cooling lubricant:
Prior to commissioning, a leak test shall be performed and documented in a test certificate (specification of the test substance, test date, duration of test, etc.). The container statistics shall be documented. A foundation plan (including the maximum possible filling weight) shall be submitted for approval. Sufficient ground clearance and visibility for visual leak checks shall be ensured (in accordance with the AwSV).

Design features
Round or square stainless-steel containers with smooth inner walls, outer finning/reinforcement. Inspection openings allowing entry into the containers shall be provided

31.2.2 Inlet Cup/Distributor

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To "detension" and depressurize the substance and ensure that it enters the downstream system section in a calmed state. Flow guidance in the inlet distributor shall ensure that no additional air gets into the cooling lubricant and that foaming is kept to a minimum.

31.2.3 Prefilter as a Coarse Cleaning Stage

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Function
Separation and discharge of most of the chips from the cooling lubricant.

Design features
The following criteria shall be coordinated project-specifically for the discharge unit:

- Type of scraper conveyor chains (stop, solid pin, etc.)
- Attachment and spacing of the angle iron followers
- Suitable chain guide to prevent jamming; at least 5 mm thick closing strips made from suitable material
- Minimization of the fluid discharge at the discharge neck.
- Cleaning of the followers in the discharge head.
- A concept for aligning and replacing axles, bearings and sprockets of the deflectors.
- Reliable shutoff of the drive of the conveyor chain in case of sudden overload and torn chain (torque support with switch, electronic running monitor of chain or followers, load monitor, etc.)
- A concept for replacing the gear motors.
- A concept for tensioning and aligning the conveyor chains.

31.2.4 Vacuum Belt Filter as Main Cleaning Stage

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Function
Filtration of the (precleaned) cooling lubricant by means of an endless belt and filter fleece.

A suitable extraction system shall be installed for removing air bubbles in the lower chamber.
The scraper conveyors shall be coordinated project-specifically according to the criteria: chain type: (stop, solid pin), attachment of follower, min. 5 mm thick closing strips, cleaning of chain and filter belt, ensuring of belt tension, threading of new belt, monitoring for reliable shut-off of the conveyor chains in case of overload.
The filter shall be equipped for operation with the endless belt and single-use fleece.
The initial equipment for each filter shall be coordinated (at least two endless belts and 5 rolls of single-use fleece, each 100 m.)

Design
In the filter, it shall be possible for the cooling lubricant flow to be cleaned using a single-use fleece in accordance with the technical design (machine supply, belt flushing, filling of the clean-air reservoir) immediately prior to regeneration.
The clean-air reservoir shall be dimensioned such that two regeneration cycles can be performed in succession. The result shall be coordinated with the relevant department.

31.2.5 Pressure Belt Filter as Main Cleaning Stage

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Function
Filtration of the (precleaned) cooling lubricant by means of either the endless belt or filter fleece.

Design features
Square filter containers, separated by a multi-section slotted screen base into the upper and lower chamber. The initial equipment includes for each filter two endless belts and five roles of single-use fleece, each 100 m.

Design
The entire system shall be designed such that negative overflow (of dirt into the clean tank) is avoided. The clean tank shall be big enough to ensure an infeed of at least 15 minutes. The contractor is responsible for designing the filter surface for the application described.

31.2.6 Automatic Backwash Filter

5

Function
Quasi-continuous filtration of the precleaned cooling lubricant in the main flow (inlet) to the machine tools.

Design features
Regeneration is triggered via a preselectable time or pressure differential. During regeneration, no pressure surges greater than 0.2 bar shall be transferred to the infeed.
Design

The design of the required filter surface or the required number of backwash filters shall be presented to the contractor.

31.2.7 Precoat Filter Systems

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Function
An auxiliary material is used for filtration purposes that is washed onto the filter elements with the liquid flow.

Design features
An individual inspection of the precoat filter dome as pressure device is part of the scope of delivery.

Design
The overall system shall be large enough to ensure an infeed of at least 15 minutes. The contractor shall be responsible for the design of the filter surface.

31.2.8 Pump/Pump Groups

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Function
Conveyance of cooling lubricant

Implementation
In the case of pumps that convey cooling lubricant containing chips or sludge, the appropriate design shall be coordinated with the manufacturer and the client.

Note
The pumps (motors, housing, etc.) shall be installed such that they can be easily transported if they need to be replaced or repaired. Hoist rails, possibly with a stable substructure, for installation above pump groups (filter/system pumps) shall also be planned and delivered.

Controlling system pumps
The machine supply pumps (system pumps) are pressure-regulated by means of frequency converters. The cut-in and shutoff of the pumps shall be coordinated in detail with the client.

Pump function monitoring
Pump groups are equipped with a reserve pump that switches on automatically when a required pump fails. An automatic pump changeover circuit ensures that all pumps are uniformly required.

31.2.9 Floor Pan

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Function
Retention volume as per Appendix 1 to Section 4 of the AwSV: Requirements regarding equipment intended for the manufacture, treatment, or use of water-polluting substances (HBV systems) if the installation area is designed as a retention space.

31.2.10 Pump Sump and System Emptying

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Function
Low point of a system area for collecting and conveying away fluid.

Implementation
A concept for the complete system evacuation shall be presented and coordinated with the client.

31.2.11 Pipelines General

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Implementation
The nominal widths shall be based on the following flow speeds:
Suction lines: max. 1.0 m/s for oil; 1.5 m/s for watery substances
Pressure lines: max. 2.0 m/s for oil; 2.5 m/s for watery substances

Suspension/support
The steel construction required for supporting the internal system pipework is included in the scope of delivery. For the shop pipework (infeed/return flow), the support on the steel construction, including the required attachments, shall be coordinated.

Supply line
Implementation
The distance of the flange connections on straight sections, upstream and downstream from each curved section and purging connections shall be specified. A 3D piping diagram and structural calculation of the pipes are included in the scope of delivery.

Return line
Implementation
A 3D piping diagram and structural calculation of the pipes are included in the scope of delivery; clogging shall be considered. During assembly, the seals shall not project into the pipeline, so that no chips become stuck.

31.2.12 Fittings

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Implementation
All fittings shall take the form of flanged-on fittings, not breaker fittings. Automatic valves shall be controlled such that the system enters a safe state if the auxiliary energy supply fails. All automatic valves are fitted with inductive end position switches. Suitable sealants shall be used.
When the nominal widths are defined, the following flow speeds shall be used as a basis (as for the pipelines):
Suction side: max. 1.0 m/s for oil; 1.5 m/s for watery substances
Pressure side: max. 2.0 m/s for oil; 2.5 m/s for watery substances

Shutoff devices:
DN 50 and smaller: ball valves
DN 65 and larger: lock-up valves

Manual lock-up valves up to and including DN 125 with hand lever and screen disk
Manual lock-up valves larger than DN 125 with hand wheel and gearing

Other fittings:
Nonreturn valves as ball check valve; also as wafer-type valve following consultation.
Fittings with characteristic curves that are as constant as possible shall be used for all setting and control tasks, i.e. valves, but not shutoff devices such as ball valves or flaps.

31.2.13 Compensators

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Implementation
For each pump from 15 kW, a compensator shall be installed on the pressure side to prevent vibration transfer. The design shall be coordinated.

31.2.14 Refilling Devices

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Function
Compensation of losses through evaporation or carryover in semiautomatic operation. The specified quantity (level-monitored) is replenished as required.
For systems with a changing travel volume (rinsing container in production), the calculation of the permissible replenishment volume shall be suppressed during filling in order to ensure that the specified quantity is reliably replenished. The filling process is aborted only by the switching point for the maximum working volume/by the overfill protection.
For emulsion systems, the proposed values for water and concentrate are calculated on the basis of the concentration required by the operator. If the value for water is exceeded, the controller automatically recalculates the value for the concentrate.

Design of oil systems
Replenishment device comprising a dirt trap, pneumatically driven valve (spring force, closing) and oil meter with on-site display and pulse output with 10-liter pulse in a DN 50 replenishment line to the system dirt container.

Design of emulsion systems
Design as per
- Concentrate meter with 1-liter pulse
- Water meter with 10-liter pulse
- Static mixer installed in the pipeline for better emulgation
- Introduction of fresh cooling lubricant under the bath surface (in replenishment mode) to prevent the build-up of lime soaps
- Pneumatically driven valves (spring force, closing)

31.2.15 Cooling

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Implementation
The cooling lubricant is cooled by means of plate heat exchangers. In this process, the cooling lubricant is pumped to the plate heat exchangers from the feed line or clean tank and then returned to the feed line/clean tank. The cold water flow is regulated. The design, including sensor system and actuator control, shall be coordinated with the client.

31.2.16 Scraper Conveyors

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Design of the conveyor trough
- Material, height, width, length of the individual pieces
- Seals
- Guides/closing strips, covers, threaded connections
- Inspection openings, including locks as per safety concept

Chains and followers
Chain material, followers, angular brackets, threaded connection locking
Chain wear concept

Drive Station
Accessibility, gear motor design, shutoff at overload, maintenance/safety concept.
Drive chain wheels with side-hardened teeth.

Relay Clamping Station
Accessibility, maintenance/and safety concept. Tensioning the chain, chain pulling load.

Ascending and Descending Arcs
The wear concept shall be indicated. All arc sections shall be fitted on both sides with a connecting flange to the adjacent conveyor sections so that they can be easily detached during repair work.

Discharges/Chutes
Chip discharge chutes are bolted to the discharging conveyor and are easily removable. For conveyors with cooling lubricants, a flow-optimized handover shall be ensured. The chutes shall be designed such that the escape of chips and cooling lubricant is reliably prevented. Discharge and transfer chutes from chip conveyors shall be made from a suitable material with a thickness of at least 4 mm.

Liquid Discharges
Each conveyor that carries wet chips shall be fitted with liquid drainage with manual shutoff and piping. Depending on the design, the discharge shall be installed at the end where the most liquid accumulates.

31.2.17 Steel Construction/Lifting Platforms/Bases

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Implementation
Bolted profile steel construction; attachment to the steel construction (provided by the customer) with clamps only, otherwise as per Chapter 3: Safety Technology. The load-carrying capacity of platforms shall be at least 3 kN/m².

31.2.18 Compressed Air

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Information concerning the compressed air quality in the installation area can be obtained from the client.
As per substance requirements list. The customer shall lay a central compressed-air line to the system.
The internal distribution is the responsibility of the contractor. The disable and enable of the compressed air shall be considered as part of the safety concept.

Implementation
See Chapter 5: Pneumatic System

31.2.19 Coat/Painting

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All system components made from standard steel shall receive a single-layer primer coat on the derusted surface. Finishing coat with oil-resistant, two-component paint; color as specified by Daimler. Containers for cooling lubricants and concentrates are painted only on the outside.

31.2.20 System Identification/Labeling

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Model plate
A model plate shall be attached to the system at a clearly visible location; the model plate shall be made from aluminum, engraved or etched with at least the following information:

- Manufacturer
- System type
- Year of construction
- Series/commission number
- Total volume
- Feed volumetric flow rate

Container labeling

- The standard is issued with the specific requirement specifications.

Component Labeling
Components such as fittings, pumps, and sensors shall be fitted with permanently engraved signs showing their process and electrical designations. Following commissioning, the specified values and limits shall be indicated at the measuring points such that they can be compared with the measured value during inspections.

Pipes
The standard is issued with the specific requirement specifications.

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31.3 Chip Conveyor and Chip Conditioning Systems

The design is described in the project-specific requirement specifications.

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31.4 Machine Air Extraction Systems

31.4.1 General

This chapter concerns the suctioning of multiple machines via a central pipeline system

31.4.1.1 Paintwork

The paintwork is based on the machine-based systems of the department.

- Extraction ducts without interior painting
- Transport and assembly damage to the coating shall be touched up in the original color
- Fire-resistant paint on the duct/pipelines in the hardening shop and foundry areas

31.4.1.2 Speeds

- Oil / emulsion at raw gas end 10 - 15 m/s
- Oil / emulsion at clean gas end 12 - 14 m/s
- Drying at raw gas end 18 - 22 m/s
- MQL at raw gas end >20 – 22 m/s
- Drying/MQL at clean gas end 12 - 14 m/s
- Blow-out speed of exhaust air approx. 10 m/s
- Aluminum/magnesium machining: at raw gas end min. 20 - 22 m/s

31.4.1.3 Aluminum/Magnesium Machining

The following general implementation guidelines apply to the transport by air of exhaust air from aluminum or magnesium machining:

- Aluminum: Observe rule 109 of the German Employers' Liability Insurance/DGUV rule 109-001
- Magnesium: Observe rule 204 of the German Employers' Liability Insurance/DGUV rule 109-011
- Straight line routing
- Avoidance of restrictors and shut-off devices along horizontal sections of the scavenge line
- Bends with large radii
- A degassing sleeve (1" sleeve) at the highest point
- Fit with flexible boot with inner sleeve to ensure free and smooth passage
- System parts shall be electrically conductive and electrostatically grounded

31.4.1.4 Duct/Pipelines

- All extraction ducts shall be designed for a reduced explosion pressure of 50 mbar
- Black welded, S235JR, DIN EN 10025 (verification of material quality required)
- Component dimensions of round air ducts DIN EN 1506 in reference to the (no longer applicable) standards DIN 24151-2, DIN 24147-2 and for the flange, DIN 24145-2
- Two flanges per duct/pipe element
- Routed stress-free

- Inside as smooth as possible, roughness value 0.01 to 0.1 mm (steel, longitudinally welded, new, with mill scale)
- Oil/dust tight
- Branch-offs always 30° (deviations shall be coordinated with the department)
- Provide one condensation drain per floor
- Prevention of chip, dust or fluid deposits
- Outdoor exhaust lines shall be weather-resistant (galvanized)

31.4.1.5 Duct/Pipe Connections

- All sealing materials (no silicone) shall be compatible with the substances in the air, the materials and the adjacent components, their operating conditions and ambient conditions
- Resistant to mechanical stress (e.g. vibrations of the extraction ducts)
- Component dimensions of round air ducts DIN EN 1506 in reference to the (no longer applicable) standards for the flange, DIN 24145-2
- Component dimensions of square air ducts DIN EN 1505 in reference to the (no longer applicable) standards for the flange, DIN 24193-2
- Flange welded tight to extraction ducts (also construction-site-manufactured adapters/loose-type flanges)
- Remove beaded edges
- Permanently tight, carefully installed
- Potential equalization for all connections

31.4.1.6 Duct/Pipe Attachments

- **Threaded rods are not permitted for suspending pipes**
- The pipelines shall generally be attached with heavy-duty clamps, split in two as industrial versions, with all required support structures, including all necessary small parts
- Attached at suitable points (with static verification)
- Tension-free installation of the extraction ducts
- Protected against lateral movement or oscillating (towards the axis)
- Galvanized or with priming and finish coat

Pipe clamp including attachment consisting of:

- 1 clamping plate attached to the shop carrier with carrier claws or 2 clamping plates clamped to the shop structures with bolts, with an overall length <= 50 cm between pipeline and clamping plate with profiled steel and pipe clamp
- Pipe clamp including deformation-proof attachment to the building by means of L, U or I section at a fastening distance of approx. 3 to 6 m, depending on local conditions

Safety-relevant component parts:

- Safety relevant component parts (e.g. fire barriers) shall be protected against acting forces and vibrations (note elongation of the extraction ducts from heating)

Reinforced design in front of and behind these components

31.4.1.7 Spark Quenching Section

If active spark quenching (e.g. with water jet, CO2, etc.) in the raw gas is to occur, a spark quenching section shall be provided at the raw gas end (14 x DN, without slope).

- Horizontally or vertically
- No downwards slope to the machine

31.4.1.8 Potential Equalization of the Pipelines for Process Exhaust Air

Potential equalization at a pipeline (at raw and clean gas ends), pipeline components and process air systems occurs by means of cable connectors. (The latter shall form a conductive connection with a minimum cross section of 10 mm²).

Connection to potential equalization every 30 m at the foundation grounding electrodes or steel structure of the building.
The quality of the potential equalization shall be documented in a measurement report (component of the inventory documents.
(see MBN 9666-3)

31.4.1.9 Potential Equalization of Systems

(see MBN 9666-3)

31.4.1.10 Lightning Protection

Lightning protection in coordination with the department

31.4.1.11 Accessibility of System Components

In coordination with the department

31.4.2 Technical Description of the Process Air Components

31.4.2.1 Main Extraction Lines

For transporting the process exhaust air to the process air system

General version:

- Like ducts, pipelines and connections
- Penetrating oil separator/draining upstream from each floor (does not apply to drying), generally return of emulsion / MQL / WW / hardening water into inspection glass and oil into RPS
- With maintenance openings
- With potential equalization
- Prevention of chip, dust or fluid deposits, specification of cleaning cycles
- Raw and clean gas measurements

Attachments:

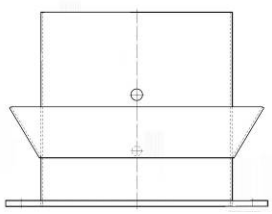
- Like duct and pipeline attachments

31.4.2.2 Machine Connection

The components described in MBN9666-2 – Exhaust air, process-related – belong to the scope of the machine supplier.
For the delivery to the pipeline system:

General version:

- Like ducts, pipelines and connections
- Upstream from the throttle valve a maintenance opening accessible as much as possible without aids
- With measuring point (bore) including plug and corresponding measuring point labeling
- No fluid (condensation) drainage towards the machine, horizontal piping (no slope)
- Attachment of the FLEXIBLE hoses (approx. 1 m length/machine) at the machine end by means of vertical "hose connection with fluid drain".
- Details on preventing chip discharge shall be coordinated with the department.



Example: hose connection with fluid drainage

Design:
For emulsion, oil mist and dry extraction:

- Flexible with plastic hose (prevent sagging)
- If necessary, with adapter for quickly retrofitting a pneumatic lock-up valve

For abrasive substances:

- Flexible with metal hose
- If necessary, with adapter for quickly retrofitting a pneumatic lock-up valve

For washing machines:

- Rigid and with compensator (PPS pipe)

For test stands (e.g. helium leak test, cold test, etc.):

- Rigid (black welded pipe)

31.4.2.3 Maintenance Opening

For maintenance, cleaning and inspection during operation

General version:

- Like ducts, pipelines and connections
- Height min. 80% of NW, length = 2 x height
- Inside as smooth as possible (low pipe friction coefficient, avoids deposits)
- Maintenance opening secured against falling through suitable jigs and fixtures (locking chain, hinge, etc.)

Installation:

- Installation above the center axle, preferably attached offset 45° from pipe upper edge
- Upstream from each bend, each branch-off, each throttle valve, upstream and downstream from the fire barrier and every 12 m in the straight shot (at accessible point)
- Maintain a minimum distance of >1.5 m to the lock-up valve (risk of injury)
- Frame welded tight against substances with extraction duct
- Accessibility via lifting or other platform or auxiliary structure
- Do not install any maintenance openings near light sensors and spark detectors

31.4.2.4 Condensation Drain

For draining substances condensing in the pipeline

General version:

- Consists of a nipple welded onto the pipeline with subsequent pipeline and stopcock DN50, a waste trap, the draining pipeline and an inspection glass
- All pipeline connections flanged with oil-resistant seals

Oil-containing process exhaust air:
The pipelines at the raw and clean gas ends shall be fitted with siphons at the low points (floors) and at the condensation separator (note connection height). The return flow occurs separately into the nearest circulating pump station of the machine tool (junction possible) or into an inspection glass with stopcock and blind plug (no hose).

Process exhaust air containing MQL, EMU and WW:
The pipelines at the raw and clean gas ends shall be fitted with siphons at the low points (floors) and at the condensation separators (note connection height). The return flow occurs separately into an inspection glass (no hose) with stopcock and blind plug near the system (junction possible).

31.4.2.5 Siphon

For the draining fluids from system components with different pressure conditions

General version:

- Design as for water / cooling lubricant piping
- Min. pipe diameter 2"
- Design according to Dpmax. of the fan
- A detachable connection via flange and companion flange at siphon inlet and outlet
- With filling connection above and draining opening at lower pipe bend from the waste trap
- Filling of the siphon traps before initial startup of the system

31.4.2.6 Leakage Drain with Inspection Glass

For collecting, displaying and draining fluids from system components

General version:

- Design as for water / cooling lubricant piping
- Min. pipe diameter 2"
- Consisting of 2x stopcocks and an inspection glass approx. 0.7 m (no hose)

31.4.2.7 Deflector Hood

For avoiding weather-related fluid ingress in the extraction ducts

General version:

- Like ducts, pipelines and connections
- Oil-tight
- Rainwater drain sufficiently large and clog-proof
- In the case of large nominal widths split in two if possible or not installed at the end of the exhaust air line and with cleaning openings in the connected pipeline

31.4.2.8 Throttle Valve Manually Operated

For regulating the flow volume

General version:

- Like ducts, pipelines and connections
- Moving or electrical equipment shall be designed and installed according to the risk analysis (risk of fire and explosion) and the premises documented
- Heavy-duty, welded, oil-tight / dust-tight industrial design
- Blade position visible from the outside
- Without inner stop
- Easy access (without aids if possible)

Locking version

- Throttle valve with hexagon screw lockable in nominal point
- Locking mechanism firmly welded on to duct
- Continuously variable angular position with black plate locking mechanism

31.4.2.9 Automatic Lock-Up Valve

For interrupting the air flow

General version:

- Like ducts, pipelines and connections

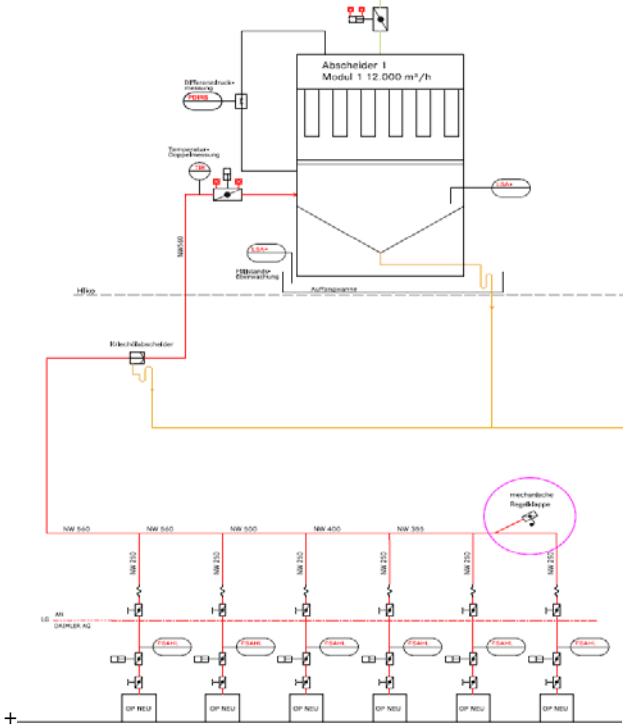
- Moving or electrical equipment shall be designed and installed according to the risk analysis (risk of fire and explosion) and the premises documented
- Heavy-duty, welded, oil-tight / dust-tight industrial design
- With flange connection according to DIN 24154-2
- Shall open against a pressure differential of at least double the fan pressure
- Blade position visible from the outside
- Sealing with metallic stop ledge in the housing
- Closing without energy
- Version as safety quick-closing valve with closing time < 1.5 sec.
- End position cushioning
- Limit Position Monitoring
- Perforated plate cover for moving parts outside
- Easy access (without aids if possible)

31.4.2.10 Mechanical Control Flap

For regulating or securing a constant air flow with machines switched off

Use in the main line or at machine connection at suitable point

- Suitable for vacuum pressure regulation in scavenge lines
- Pendulum (kick-back) flap shall be designed and adjusted for the applied vacuum
- The flap leaf shall close tightly in the closed state
- Flow volume regulatable with weight and lever arm according to the vacuum



31.4.2.11 Draft Diverter

For capturing exhaust air from closed containers while avoiding fluid discharge and unpressurized

General version:

- Like ducts, pipelines and connections
- Capture of fluids shall be reliably prevented
- Edge smoothed
- No interference contours (screws) in incident flow area

Design:

- Containers with infrequently varying fill levels and substance temperature similar to room ambient temperature, approx. 300m³/h with NW100
- Containers with frequently varying fill levels and substance temperature similar to room ambient temperature, approx. 500m³/h with NW125 corresponding to substance variation in the container
- If necessary, multiple extraction points with draft diverters
- Pressure belt filter at 1000 m³/h, with multiple alternating pressure belt filters with pneumatic lock-up valve
- Reduce extraction volumes if substance temperature higher than room ambient temperature
- **Containers with filter aids are not suctioned**

31.4.3 Technical Description of the Machine Air Extraction Systems

31.4.3.1 Guaranteed Emissions Limit Values of the Machine Air Extraction Systems

See project-specific agreements

31.4.3.2 Guaranteed Sound Emissions at Machine Air Extraction Systems

See MBN 9666-1 Sec. 5.6

31.4.3.3 Dry-Type Air Filter (MQL: version to be coordinated with the department)

For separating out substances contained in dry exhaust air

Filter variants:

- Cartridge filter
- Rigid body filter (with special coating for MQL)

General version:

- The separator(s) shall be designed for a reduced explosion pressure of 50 mbar
- Designed for the substances in the exhaust air
- Moved or electrical equipment shall be designed and installed according to the risk assessment of the contractor (risk of fire and explosion) and the premises shall be documented
- If necessary with appropriately designed pre-separator stage for separating out coarse transported substances
- No formation of layers (caking) in the filter medium and on the housing walls
- Suitable for 3-shift operation
- Potential equalization of all filter components
- Per filter unit a compressed air shutoff unit of the filter cleaning system accessible from the control level (for the fire department)
- Incl. compressed air reservoir and blow-off valves

Filter elements:

- Filter elements arranged vertically (fire fighting)
- Filter material barely flammable
- Dust tight between the filter stages and the housing structure
- Filter elements easy to disassemble and clean
- Grounded
- Display disposal path with disposal key and fire class

Cleaning of the filter elements:

- During filter operation
- Differential-pressure-controlled or according to programmable time or program cycles
- The program parameters are specified by the contractor and shall be documented

Housing:
- Vacuum-tight, made of sturdy, welded sheet steel
- Version shall be coordinated with safety concept
- Deformation resistant, wearproof
- Door with quick-release fasteners and opening by 180°
- Adapted to the installation site

Equipment:
- Vibration limit switch for detecting a coat structure in the separator with roof over the measuring equipment

Process messages:
- Temperature measurement in the discharge container, at raw gas and clean gas ends in the separator as well as at raw gas end in the pipe/duct
- Fill level sensor for detecting an inadmissibly high fill level in the separator

Differential pressure monitoring:
- Differential pressure indicator units in Pa
- Differential pressure monitoring of the fuel filter elements per filter stage
- Adaptation of the cleaning stage to the filter load, resulting in energy saving and protection of the fuel filter elements
- Upper and lower differential pressure threshold each separately adjustable
- Two additional limit contacts, also separately adjustable, for current monitoring
- Analog differential pressure gage for each filter stage
- Accumulator temperature-compensated
- Maintenance-free
- Protection class IP 65
- Assembly at an easily accessible place without vibrations, protected against contamination and damage

Fire protection:
See section on fire detection system and extinguishing concept

Special requirements for explosive dusts:
- Provide for pressure relief (rupture disks or pressure relief stack / ducts)
- Unless otherwise specified in the general preliminary remarks, inert substances may be injected into the air stream to prevent explosive mixtures.
- The surfaces of component parts subject to air flow shall be electrically conductive and grounded
- Monitoring of the flow rate

Special requirements for MQL:
- Separation process without filter aids
- Rigid body filter with special coating

31.4.3.4 Oil, Emulsions (MQL) Mist Separator (Fine Fiber)

For separating out cooling lubricants and aerosols

Boundary conditions: Requirements as per safety data sheets for the employed substances

General version:
- The separator(s) shall be designed for a reduced explosion pressure of 50 mbar
- Designed for the substances in the exhaust air
- Moved or electrical equipment shall be designed and installed according to the risk assessment of the contractor (risk of fire and explosion) and the premises shall be documented
- Filter may comprise pre-filter stage, main filter stage and possibly post-filter stage
- If clean gas is discharged into the room air a depth-loading filter may be used as a post-filter stage

- No formation of layers (caking) in the filter medium and on the housing walls
- Suitable for 3-shift operation
- Potential equalization of all filter components

Filter elements:
- Pre-filter stage as demistor for separating out coarse, transported substances, cleaning of the pre-filter stage with high pressure cleaner
- Main filter stage with fine fiber cartridge for high-percentage separating out of aerosols from oil- emulsion mist, filter medium as filter cartridge with multi-layer folded fine fiber and drainage substances
- Oil tight between the filter stages and the housing structure
- Filter elements with quick-clamping devices for oil filter changes without tools, simple operation, coarse and pre-filter stages regenerable and washable from outside
- Grounded
- Display disposal path with disposal key and fire class

Housing:
- Vacuum-tight filter housing made of sturdy, welded sheet steel
- Deformation resistant, wearproof
- Door with quick-release fasteners and opening by 180°
- Adapted to the installation site

Drainage / Draining:
Resistant to clogging, pressure compensation via siphon trap

Process messages:
- Temperature measurement in the discharge container, at raw gas and clean gas ends in the separator as well as at raw gas end in the pipe or duct
- Fill level sensor for detecting an inadmissibly high fill level in the separator

Differential pressure monitoring:
- Differential pressure indicator units in Pa
- Adaptation of the cleaning stage to the filter load, resulting in energy saving and protection of the fuel filter elements
- Upper and lower differential pressure threshold each separately adjustable
- Two additional limit contacts, also separately adjustable, for current monitoring
- Analog differential pressure gage for each filter stage
- Accumulator temperature-compensated
- Maintenance-free
- Protection class IP 65
- Assembly at an easily accessible place without vibrations, protected against contamination and damage

Fire protection:
See section on fire detection system and extinguishing concept

31.4.3.5 Wet Separator

For separating out explosive, inflammable and tacky dust or for suctioning cooling lubricant with high dust content

General version:
- The separator(s) shall be designed for an explosion pressure of 50 mbar
- Designed for the substances in the exhaust air
- Planning and operating wet separator in compliance with the 42nd German Federal Immission Control Ordinance (BImSchV)
- Moving or electrical equipment shall be designed and installed according to the risk analysis (risk of fire and explosion) and the premises documented

- Suitable for 3-shift operation
- Potential equalization of all filter components
- With fill level monitoring
  In the event of a system standstill > 3 days, start-up must be blocked and a warning message must be displayed: "Media must be disposed of" or "Disinfect before restarting".

Venturi unit:

- Easy to remove
- Wear-resistant
- The flow volume is monitored by means of a pressure differential and flow measuring device
- Accessibility must be guaranteed

Water piping:

- As flange or coupling connections. Screw-in or welded joints are not permitted
- Calming zones according to bends, radii, etc.
- On the suction side max. 1.5 m/s, on the pressure side max. 2.5 m/s
- Can be fully drained
- Complete internal water circuit in front axle
- Boiler pipe waste water DN >= 2" as per DIN EN 10216-1 or DIN EN 10216-1
- As per implementation standard DIN EN 10217-1
- Provide flush fittings in the waste water line
- Plant water feed with flow measurement, mud flap, solenoid valve, manual stopcock, safety valve

Take-off points for sampling are to be coordinated with the department.

Sprinkling pump:

- Sprinkling pumps always in redundant form (rolling)
- **No** suction pipe pumps

Aluminum or magnesium machining:

- Pressure relief elements at all elevated points to prevent hydrogen accumulations
- The surfaces of component parts subject to air flow shall be electrically conductive and grounded
- Vacuum meter at intake connection for monitoring the flow rate of 20 m/s
- All areas of the separator shall be easily accessible and cleanable
- Electromagnetic fill level monitoring with min./max. and lower specified contact
- Cup suction tool for floating dust to keep surface clean

31.4.3.6 Penetrating Oil

For capturing penetrating oil / fluids in pipelines

General version:

- Like ducts, pipelines and connections
- The separator(s) shall be designed for an explosion pressure of 50 mbar
- Adapted to the pipeline dimension
- Complete detection of any penetrating oil / fluids
- Installation and seal of all necessary fasteners, suspensions, substructure, siphon traps, drains, etc.
- Maintenance and cleaning openings easily accessible in the adjacent pipeline

31.4.3.7 Cyclone

For the prefiltering of coarse materials

General version:

- The separator(s) shall be designed for an explosion pressure of 50 mbar
- Designed for the substances in the exhaust air
- Moving or electrical equipment shall be designed and installed according to the risk analysis (risk of fire and explosion) and the premises documented
- Cyclone and expansion vessel in reinforced versions

- Wearproof
- Outer wall 4 mm
- Wear plate made of resistant material, 3 mm
- Wear plates bolted in segments with flat irons
- The discharge shall be interrupted for the time of the container change

31.4.4 Technical Description of the Fans

31.4.4.1 Fan with Coupling Drive

For delivering process exhaust air with and without substances contained in the air

General version:

- Design as per standardization specifications (see Chapter "Table")
- Operating point selection for 100% flow volume to right of maximum efficiency
- With rotational speed control (frequency converter)
- Housing and drive layout according to DIN 24166
- Fan unit on a base frame
- If required, the fan sound insulation shall be split in two, removable and reusable, and contain maintenance openings for the vibration sensors
- Inflow nozzle (freely extracting fan) screwed on to the volute casing from the outside (not riveted)
- Characteristic fan curve enclosed with the bid as an attachment
- Including all necessary fasteners, suspensions, substructures, drains, etc.

Impeller:

- Impeller with backward curved blades, extracting on one side
- Impeller as welded sheet steel construction
- Impeller attached with taper lock bush

Balancing technology:

- Fan impeller and other rotating parts electrodynamically balanced in two levels in quality level G 2.5 (as per DIN ISO 1940 Part 1)
- The balancing quality level (as per DIN ISO 1940 Part 1) of the complete fan unit including shaft and bearing play G 6.3

Fastening:

- The fan unit shall be attached to a base frame with spring phonolators
- The base frame shall be fixed in place on an installation surface

Housing:

- As welded sheet steel construction, welded tight consistently and reinforced with steel profiles attached externally
- Impeller housing with an inspection door on side, in easily accessible place
- Assembly opening in the impeller housing (at least 200 x 200 mm) at the top (360°) for attaching the impeller to the lifting gear:
- Drainage fitting (DN 25) with locking mechanism

Bearing:

- Unsplit
- Impeller overhung
- Plummer block or spindle bearing
- Locking of the output shaft (bearing) by pins
- Operating time of at least 25,000 operating hours
- Insulated bearings shall be used from an operating energy input >37 kW
- Vibration monitoring of the bearings

Bearing lubrication:
- Lubricant dispenser connection designed for constant lubricant dispenser
- With defined grease discharge

Motor / drive:
- Use motor as per current efficiency class
- Motor designed for frequency converter operation
- Drive from motor shaft to fan shaft via coupling
- Vibration monitoring of the bearings with sensor

Extraction ducts connection:
- Compensators against the transmission of vibrations to the extraction ducts
- Compensators resistant to employed substances
- Component dimensions of round air ducts DIN EN 1506 in reference to the (no longer applicable) standards for the flange, DIN 24145-2
- Component dimensions of square air ducts DIN EN 1505 in reference to the (no longer applicable) standards for the flange, DIN 24193-2
- Duct / pipe length on the suction side upstream from the fan (removable), at least 0.8 m in length or 1.5 x to max. 2.0 x impeller width
- Duct / pipe length on pressure side downstream of the fan (removable), approx. 1 m long

Aluminum or magnesium machining:
- Fan intake nozzle made of non-sparking material (Al, Cu)
- Pressure relief elements to allow hydrogen continually to escape (even at standstill)
- Housing inside paintwork and impeller paintwork electrostatically conductive and grounded

31.4.4.2 Fan with Direct Drive

For delivering air with and without substances contained in the air

General version:
- Design as per standardization specifications (see Chapter "Table")
- Operating point selection for 100% flow volume to right of maximum efficiency
- With rpm control (frequency converter) with exception of the wet cleaner
- Housing and drive layout according to DIN 24166
- Fan unit on a base frame
- If required, the fan sound insulation shall be split in two, removable and reusable, and contain maintenance openings for the vibration sensors
- Inflow nozzle (freely extracting fan) screwed on to the volute casing from the outside (not riveted)
- Characteristic fan curve enclosed with the bid as an attachment
- Including all necessary fasteners, suspensions, substructures, drains, etc.

Impeller:
- Impeller with backward curved blades, extracting on one side
- Impeller as welded sheet steel construction
- Impeller attached with taper lock bush

Balancing technology:
- Fan impeller and other rotating parts electrodynamically balanced in two levels in quality level G 2.5 (as per DIN ISO 1940 Part 1)
- The balancing quality level (as per DIN ISO 1940 Part 1) of the complete fan unit including shaft and bearing play G 6.3

Fastening:
With free standing fans

- The fan unit shall be attached to a base frame with spring phonolators
- The base frame shall be fixed in place on an installation surface

Housing:
- As welded sheet steel construction, welded tight consistently and reinforced with steel profiles attached externally
- Impeller housing with an inspection door on side, in easily accessible place
- Assembly opening in the impeller housing (at least 200 x 200 mm) at the top (360°) for attaching the impeller to the lifting gear
- Drainage fitting (DN 25) with locking mechanism

Motor / drive:
- Use motor as per current efficiency class
- Motor designed for frequency converter operation
- Impeller mounted on the motor shaft
- Insulated bearings shall be used from an operating energy input >37 kW
- Vibration monitoring of the bearings with sensor

Extraction ducts connection:
- Compensators against the transmission of vibrations to the extraction ducts
- Compensators resistant to employed substances
- Component dimensions of round air ducts DIN EN 1506 in reference to the (no longer applicable) standards for the flange, DIN 24145-2
- Component dimensions of square air ducts DIN EN 1505 in reference to the (no longer applicable) standards for the flange, DIN 24193-2
- Duct / pipe length on the suction side upstream from the fan (removable), at least 0.8 m in length or 1.5 x to max. 2.0 x impeller width
- Duct / pipe length on pressure side downstream of the fan (removable), approx. 1 m long

Aluminum or magnesium machining:
- Fan intake nozzle made of non-sparking material (Al, Cu)
- Pressure relief elements to allow hydrogen continually to escape (even at standstill)
- Housing inside paintwork and impeller paintwork electrostatically conductive and grounded

31.4.4.3 Accessories, Spring Phonolators

For the vibration-insulated installation of fans

General version:
- Housing made from corrosion-resistant light metal casting
- With height-adjusting device
- Structure-borne sound insulating layer including side insulation for limiting the vibration amplitudes with resonance passage
- Adjusted for the lowest operating speed with rpm-controlled fans so as to yield an insulating factor of at least 80% for excitation forces varying with the rotational speed
- Number and type according to the base frame dimensions (phonolator distance 1.5 – 2m) as per fan manufacturer

Fastening:
- Screwed, including screw sets

31.4.4.4 Constant Lubricant Dispenser Accessory

For continually lubricating bearings

General version:
- Fully automatic
- Temperature-independent
- Precise metering performance
- LC units (Lubrication Canister) can be replaced on site
- Corrosion-resistant, dust tight and splash-water protected (IP65)
- Reusable drive

Version:
- Transparent plastic casing

Drive:
- Electromechanical drive
- With exchangeable battery set

Running times:
- 4 dispensing times individually adjustable
- Preset to the corresponding lubrication interval
- Lubricant volume: LC unit with 120 cm^3

Pressure buildup:
- Automatic pressure limitation at 5 bar

Application temperature:
- –10 to +50°C ambient temperature

31.4.5 Technical Description of the Mufflers

31.4.5.1 Splitter-Type Muffler

For the sound insulation at air extraction systems

General version:
- Sturdy metal housing, impervious to fluids
- With access opening (to be opened only with tool) for easy replacement of the sound insulating elements (links)
- The access opening shall be attached to the muffler with hinges
- Including all necessary fasteners, suspensions, substructures, drains (for extracting wet substances), etc.
- Individual links not heavier than 25 kg
- With sturdy frame
- With inflow profile
- Made of non-combustible sound insulating materials DIN 4102, Part 1 or DIN EN 13501
- With perforated plate cover on both sides
- Oil-resistant film underneath
- Loose in guide and stop rails (screwed)
- Easily removable and cleanable

Installation within the housing:
- No special requirements

Installation outside the housing (weathering effects)
- Rain drainage
- Zinc-electroplate sheet steel frame

Structure frame:
- With retractable handle for easier removal
- Riveted every 25 cm

Installation situation:
- Coordinate with responsible department and WIH
- Observe transport route
- Note escape route depth

Fastening:
- If necessary, with static verification

Al / Mg machining
- Pressure relief elements at all elevated points so as to allow escape of hydrogen
- All materials around or through which air is flowing shall be electrostatically conductive and grounded

31.4.5.2 Circular Muffler

For the sound insulation at air extraction systems

General version:
- Sturdy metal housing
- Adapted to duct / pipe dimension, with flange connection
- Lp [dB(A)] at the outlet according to the frequencies shall be enclosed with the bid as a separate sheet
- Including all necessary fasteners, suspensions, substructures, drains, etc.

Noise insulation:
- Made of non-combustible sound insulating materials DIN 4102, Part 1 or DIN EN 13501
- With perforated plate cover
- Oil-resistant film underneath
- Easy to remove

Installation situation:
- Coordinate with responsible department and WIH
- Observe transport route
- Note escape route depth

Fastening:
- With static verification

Al / Mg machining
- Pressure relief elements to allow hydrogen continually to escape (even at standstill)
- All materials around or through which air is flowing shall be electrostatically conductive and grounded

31.4.6 Technical Description of the Safety Technology

31.4.6.1 Volumetric Flow Measurement

For validating the required flow velocity

In any case the version shall be coordinated with the department during the design phase.

Scope of delivery:
Transducer with back flushing with 10 m measuring hoses with connections ready for connection and mounted on instrument support
Electrical interface: M12 plug connector

Power supply 24V DC smoothed
At customer: compressed-air connection: >5 bar, <10 bar
At customer: compressed air quality as per DIN ISO 8573-1

Installation:
Flow rate at measuring point 1 < 2m/s and at measuring point 2 < 12 – 22 m/s, so that a minimum speed differential is 10 m/s at all times. Measuring point 1 is accordingly attached in the clean gas housing of the filter system and measuring point 2 at the exhaust air escape connection or fan inlet (in-flow nozzle)

Back flushing with compressed air:
The necessity for this measure shall be decided following the manufacturer's risk analysis and consultation with the department.

Calibration:
The measuring instrument shall be calibrated prior to delivery to the operator. The corresponding measurements and acceptance inspections shall be documented in the system documentation.

31.4.6.2 Fire Barrier

For preventing smoke or flames reaching another fire compartment

General version:
- For cordoning off fire compartments
- With general technical approval issued by the German Institute of Structural Engineering in Berlin
- Free flow area
- Suitable for abrasive exhaust air substances
- With limit stop monitoring
- Manual closing for function check purposes
- Individual acceptance by VDS
- Impervious to fluids, with draining

Installation:
- As per approval notice
- Easily accessible

Activation:
- As per approval notice

Extraction duct holder:
- Extraction ducts routed stress-free
- No forces from elongation, buckling, vibrations of the extraction ducts acting on the fire barrier

Dust extraction system:
- Extraction ducts transporting combustible dust particles shall be fitted with additional sensors

31.4.6.3 Fire Detection System

For monitoring flying sparks in pipelines so as to initiate appropriate countermeasures

General version:
- The fire detection system consists of the control console, temperature alarm, light sensor, spark detector, red flashing light, electrical horn and the test device.
- Control console; display of alarm, spark number, quenching time, area identifier. Spark threshold, time threshold and quenching time can be programmed. Memory for events. Can be configured via the display. Potential-free sum relay contacts and potential-free relay contacts for the monitoring area for the alarms and malfunction messages and for implementing deactivation or locking.
- Daylight spark detector with alarm holder in V2A

- Potential-free message contact as changer for alarms, malfunctions or deactivation, including software configuration
- Temperature alarm, ambient temperature < 70°C, possible activation temperatures: 60/71/88/107/135/162/182/232/260/316/ 385°C
- Alarm electronics for wall installation or switch cabinet installation
- Red flashing light and electrical alarm horn
- Test lamp, installed in DLD

Protection class:
- Standard housing IP65

Assembly:
- Easily accessible,
- without vibrations,
- protected against contamination and damage

31.4.6.4 Extinguishing Concept at Dry-Type Air Filters (MQL-LDS and dry-type air filter process air systems)

Design:
- Version complies with Association of Insurers (VdS) guidelines for semi-stationary extinguishing systems, VdS 2395-1. The version of the quenching nozzle may be selected in deviation from the VdS guideline.
- The described version represents the maximum expansion. The extinguishing concept can be adapted according to the specific installation situation. Implementation in press fitting systems with approval for quench water lines.

Planning consideration of additional load from quench water in the filter:
- Employed quenching nozzles, including their characteristics, are queried in the service specifications
- The possible fill volumes are computed from the characteristic of the quenching nozzle at 10 bar maximum pressure and the number of the employed nozzles/filters. A maximum quenching time of 30 minutes is then set
- **The computed data is the additional load that must also be considered in the static calculation!**

Feed-in level:
- Feed-in point on the working level (near traffic route, possibly on the building's outside wall, in coordination with the fire department)
- Feed-in via C-Storz with blind coupling, manual stopcock with limit stop monitoring sealed as expansion device and pressure monitoring for the fire department
- For each filter one feed-in point/or collective feed-in
- Labeling of **feed-in** with:
  1. Information label based on DIN 4066 (red frame on white background with black lettering), weather-resistant in outside area with lettering information specified
  2. Overview diagram of the systems to be quenched (possibly also shown in the safety layout)
- Pipeline DN 50 galvanized with PN16 threaded connections and the bracket spacing of the heavy-duty clamps reduced by half

In the system area (filter):
- Compressed air stopcock for cleaning per filter without aids accessible and manually operated, with information label if possible in the vicinity of the quench water drain
- In the filter one or more quench nozzles with Association of Insurers (VdS) component recognition marking

- Quench water drain per filter via manual stopcock with limit stop monitoring into a straight and a curved line segment with coupling
- Transparent plastic hose quickly detachable via a coupling and leading into a DN100 collector (free access to the quench water drain for breaking up clogging)
- Collector leading up to the working level (near traffic route, possibly on the building's outside wall, in coordination with the fire department)
- Labeling of **draining** with:
  information label based on DIN 4066 (red frame on white background with black lettering), weather-resistant in outside area with lettering information specified
- Inspection/access openings at the filter housings for fire department, if necessary with base and cat ladder

Draining level:

- DN100 collector via a manual stopcock in "OPEN" position secured with padlock 3-3-98
- Drainage into an IBC-1000l container on movable supporting frame on the working level (near traffic route, possibly on building's outside wall, in coordination with the fire department)
- Labeling of **draining** with:
  information label based on DIN 4066 (red frame on white background with black lettering), weather-resistant in outside area with lettering information specified

Extinguishing agent connection labeled as per DIN 4066
Fire department labels for feed-in and draining -

Feed-in:

Dry extinguishing system
Feed-in pressure max. 5 bar
Extinguishing time max. 20 min
System 1/XYZ
Filter X
Power supply

Draining:

Dry extinguishing system
System 1/XYZ
Filter X-Z
Draining

Compressed air stopcock:

Compressed air stopcock
System 1/XYZ
Filter X

31.4.7 System Labeling and Documentation

31.4.7.1 Labeling of the System Technology

See project-specific documents from the department

31.4.7.2 Measuring Point and Test Section at the Pipeline

For creating and labeling the measuring points on the pipeline

General version:

- Measuring point consisting of: bore D=25 mm, 1" sleeve with 1" screw plug, firm connection with cap half shell, screwed oil-tight to duct or pipeline

- Measurement hole drilled at suitable and accessible point
- Note test section upstream from measuring point 3xNW and downstream from measuring point 2xNW

Labeling:

- Labeling with substance-resistant and aging-resistant material
- Can be washed off
- Bonded
- Color: white background, black lettering
- Size A5 (larger if necessary!)

Measuring point:

The measuring point shall be labeled with the following information at an easily visible place:

- Measuring point – number (system number (without plant section). String. Connection example: 240.4.20)
- NW
- Specified $V'_{specified}$ EPMK in m³/h
- Actual V'_{actual} in m³/h
- Specified $v_{specified}$ in m/s
- Actual v_{actual} in m/s
- Date/company

Messpunkt		123.4.5
DN	in mm	200
$\dot{V}_{soll}$ EPMK	in m³/h	2.200
$\dot{V}_{ist}$	in m³/h	2.100
v_{soll}	in m/s	19,45
v_{ist}	in m/s	18,57
Datum/Firma		06.03.19/xxxxx

Identification location:

- on the pipeline
- at an easily visible place
- with arrow in flow direction

31.4.7.3 Measuring Point in the Measuring Point Diagram

For labeling the measuring points in the measuring point diagram

General version:

- Measuring point diagram part of the documentation for the system overview and distribution of the air volumes at the machines and at the raw and clean gas ends

Measuring point information:

- Measuring point – number (system number (without plant section). String. Connection example: 240.4.20)
- NW
- Specified $V'_{specified}$ EPMK in m³/h
- Actual V'_{actual} in m³/h
- Specified $v_{specified}$ in m/s
- Actual v_{actual} in m/s
- Date/company

Messpunkt		123.4.5
DN	in mm	200
$\dot{V}_{soll}$ EPMK	in m³/h	2.200
$\dot{V}_{ist}$	in m³/h	2.100
v_{soll}	in m/s	19,45
v_{ist}	in m/s	18,57
Datum/Firma		06.03.19/xxxxx

System data information:

- See example

Max. Anschlussleistung Ventilator	_____	in kW
Gem. Anschlussleistung Ventilator	_____	in kW
Max. Pressung Ventilator	_____	in Pa
Gem. Pressung Ventilator	_____	in Pa
Einstellung Gesamtvolumenstrom	_____	in m³/h
Max. Volumenstrom	_____	in m³/h
Einstellung FU	_____	in %
Datum / Firma	_____	_____

Identification location:

- In the measuring point diagram (CAD drawing entered in FAPLIS)

31.4.8 Appendix

Design of the fans in following gradations

Flow volume [m³/h]	**Pressure NP** [daPA]	**Intake diameter** [mm]
7500	250	355
8400	315	355
9000	355	355
9600	400	355
10200	450	355
10800	500	355
12000	250	450
12000	630	355
13440	315	450
14160	355	450
15000	400	450
15900	450	450
16800	500	450
18900	250	560
18900	630	450
21300	315	560
22500	355	560
24000	400	560
25500	450	560
27000	500	560
30000	250	710
30000	630	560
33600	315	710
36000	355	710
37800	400	710
40200	450	710
42600	500	710
48000	250	900
48000	630	710
54000	315	900
57000	355	900
60000	400	900
63600	450	900
67200	500	900
75000	630	900

A		E	F		X	Y	Z
		5					

31.5 Wastewater Systems

The design is described in the project-specific requirement specifications.

A		E	F		X	Y	Z
		5					

31.6 Vacuum Chip Disposal

The design is described in the project-specific requirement specifications.

A				E	F		X	Y	Z
1	2	3	4	5		6	7	8	9

32 Appendix

32.1 Abbreviations

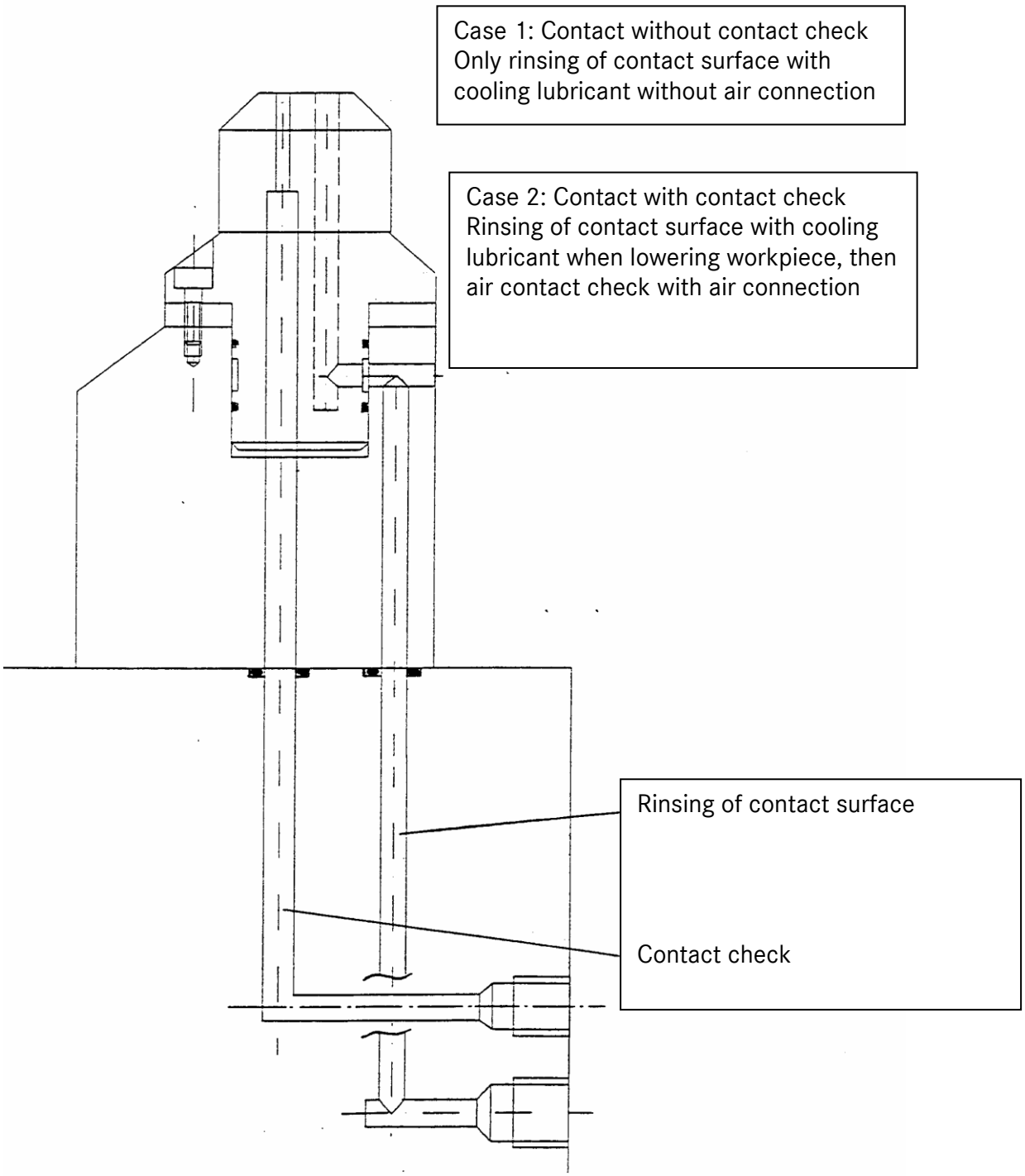
AwSV	German ordinance on installations handling water-endangering substances and on departments
BGR	Rule of the German Employers' Liability Insurance
BImSchV	Federal Emission Control Ordinance
BQF	Approval of source of supply
DBL	Daimler-Benz supply specifications
DVGW	German Technical and Scientific Association for Gas and Water
EU	European Union
FKM	Fluorocarbon rubber
FU	Frequency converter
HP	High pressure
HP deburring system	High pressure deburring system
KAE	Chiller unit
KMF	Synthetic mineral fibers
KSS	Cooling lubricant
KUV	Power sub-distributor
LISA	Liquid indicator switch alarm
MBN	Mercedes-Benz standard
MDM	MaterialDataManager
MFL	Material approval list (Materialfreigabeliste), listing the approved component parts from the MFLs and special releases.
MQL	Minimal quantity lubrication
MRL	Machine Directive
PIS	Pressure indicator switch
PPA	Production planning major assemblies
PVDF	Polyvinylidene fluoride
RPS	Circulating pump station
UVV	German accident prevention regulations
ÜMA	Machine extraction monitoring unit
DI water	Deionized water
WHG	German Water Resources Policy Act (WHG)
WLF	Roller bearing guide
WRG	Heat recovery

32.2 Index of Terms

Appendix 2

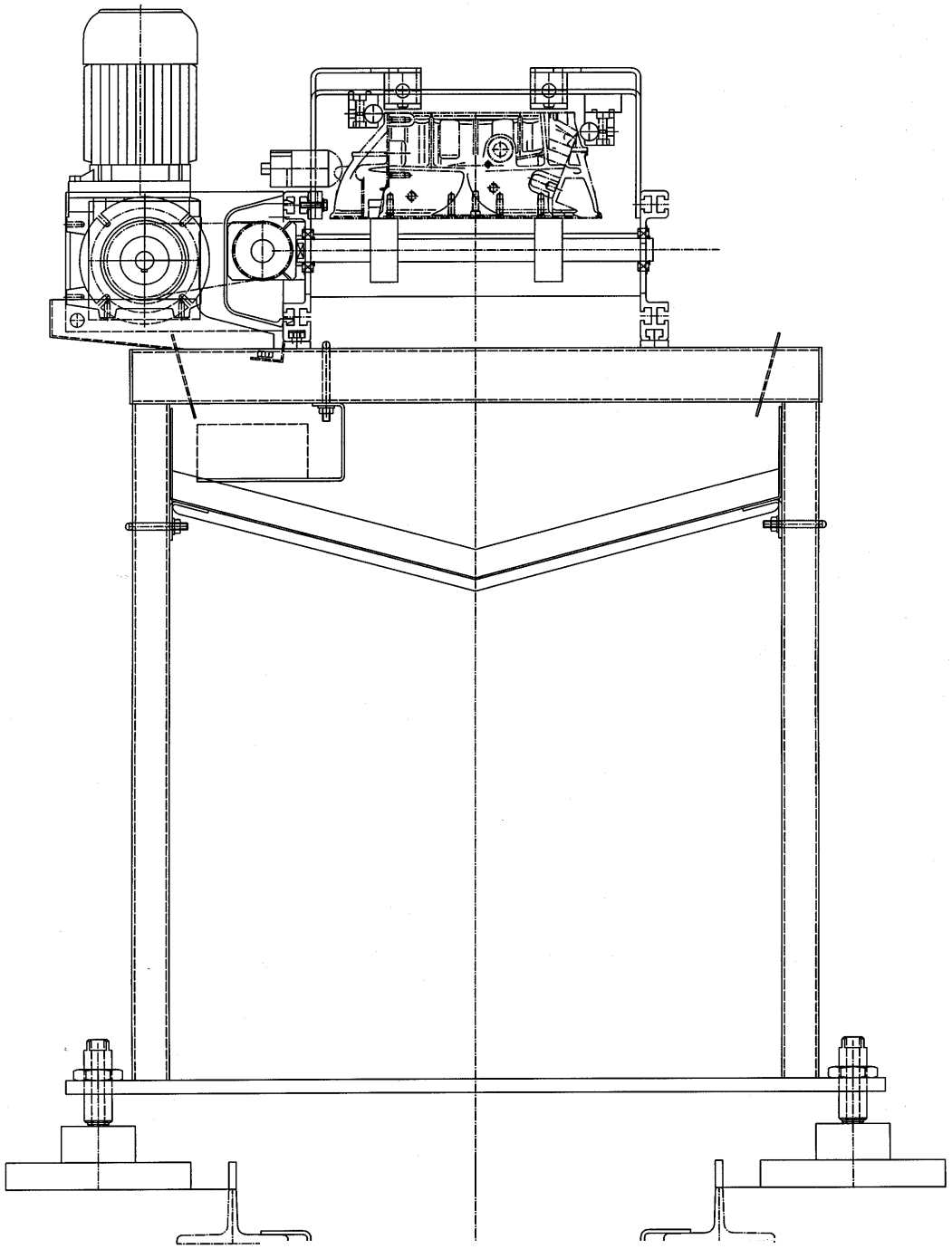
Design Example of Contact Rinsing and Air Contact Check

All O-rings made of FKM!



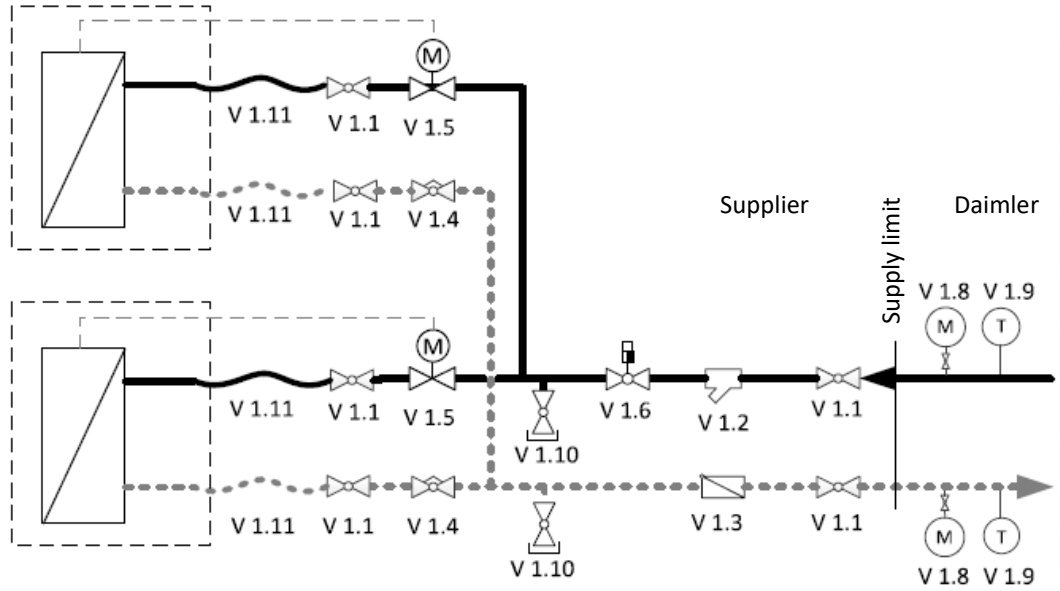
Appendix 3

Schematic Diagram of Drip Pans under Roller Conveyors



External control
Multi-switchgear cabinet cooling at central cold water

Switchgear cabinet cooler
with external regulation



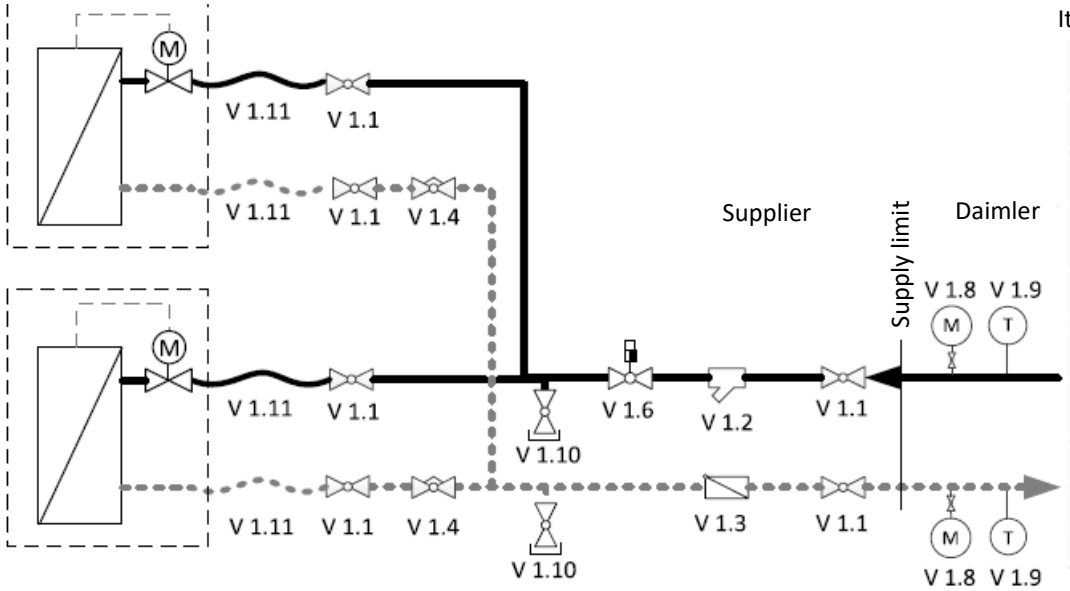
Legend

Item from Appendix 8.1	Symbol	Description
V 1.1		Ball valve
V 1.2		Dirt trap
V 1.3		Check valve (not Plant 030/034)
V 1.4		Flow rate of regulation valve
V 1.5		2-way regulation valve
V 1.6		Automatic 2-way isolating valve
V 1.8		Pressure gage
V 1.9		Thermometer
V 1.10		Rinsing ball valve with plug
V 1.11		Hose line

Internal control

Multi-switchgear cabinet cooling at central cold water

Switchgear cabinet cooler
with internal regulation

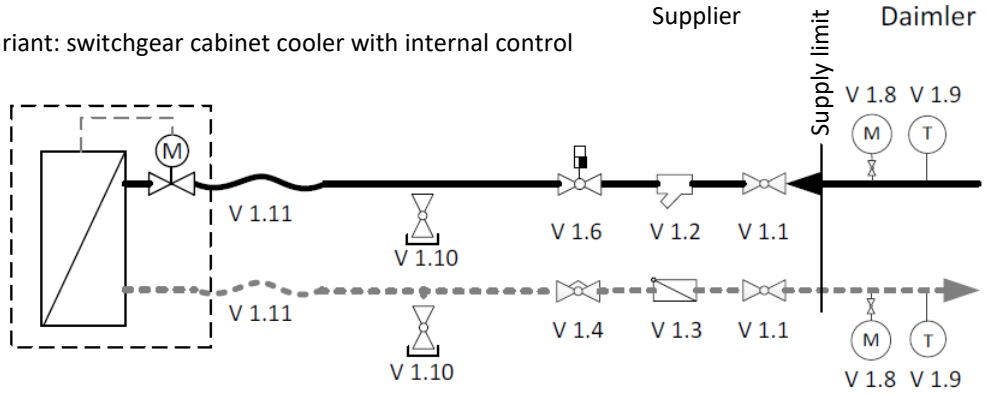


Legend

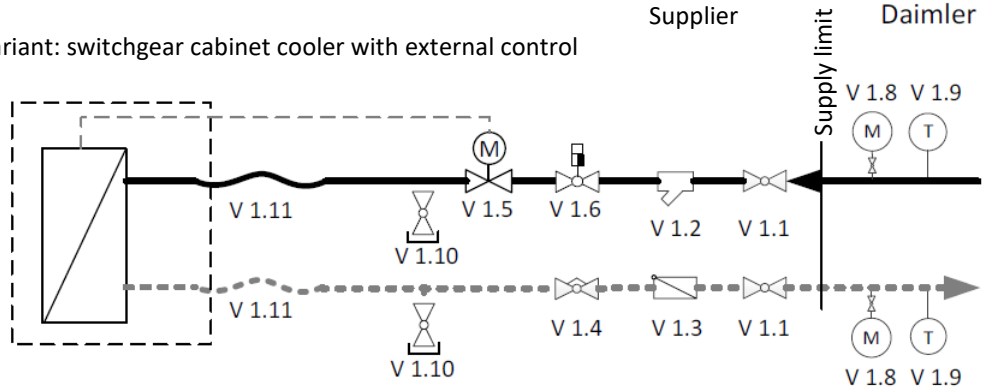
Item from Appendix 8.1	Symbol	Description
V 1.1		Ball valve
V 1.2		Dirt trap
V 1.3		Check valve (not Plant 030/034)
V 1.4		Flow rate of regulation valve
		2-way control valve (contained in cooling unit)
V 1.6		Automatic stopcock
V 1.8		Pressure gage
V 1.9		Thermometer
V 1.10		Rinsing ball valve with plug
V 1.11		Hose line

Single switchgear cabinet cooling at central cold water

Variant: switchgear cabinet cooler with internal control



Variant: switchgear cabinet cooler with external control

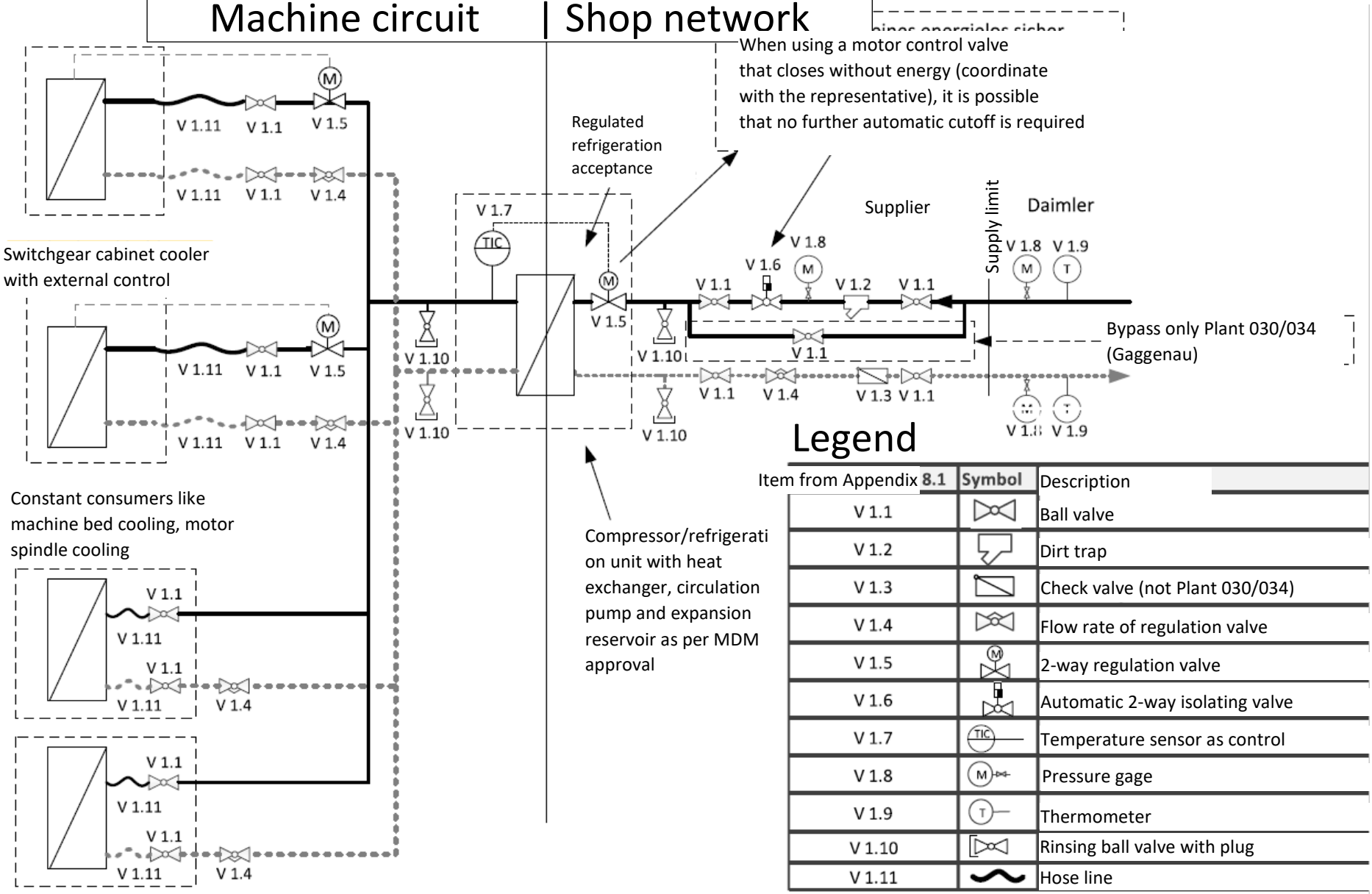


Legend

Item from Appendix 8.1	Symbol	Description
V 1.1		Ball valve
V 1.2		Dirt trap
V 1.3		Check valve (not Plant 030/034)
V 1.4		Flow rate of regulation valve
V 1.5		2-way regulation valve
V 1.6		Automatic 2-way isolating valve
V 1.8		Pressure gage
V 1.9		Thermometer
V 1.10		Rinsing ball valve with plug
V 1.11		Hose line

External control

Machine circuit | Shop network

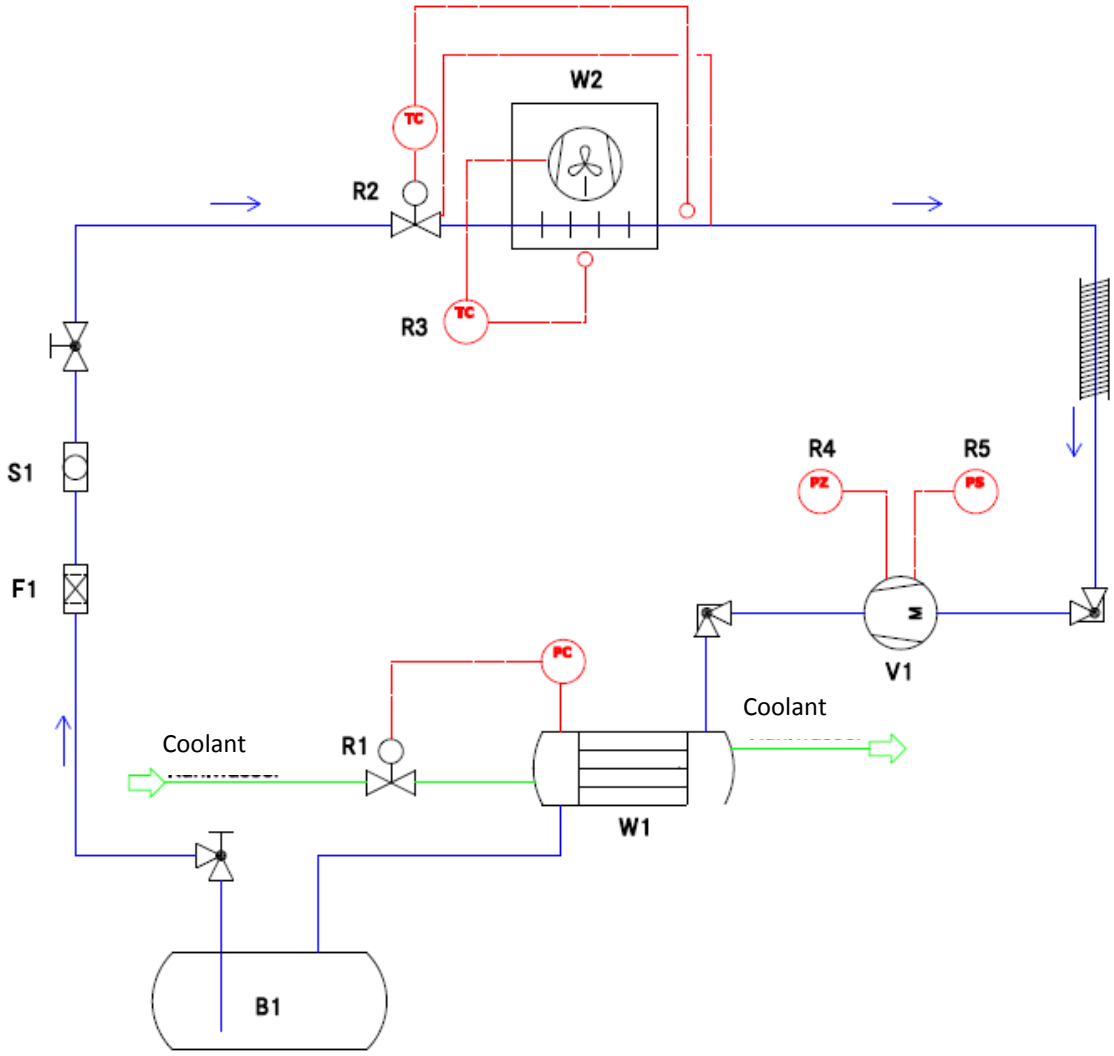


Legend

Item from Appendix 8.1	Symbol	Description
V 1.1		Ball valve
V 1.2		Dirt trap
V 1.3		Check valve (not Plant 030/034)
V 1.4		Flow rate of regulation valve
V 1.5		2-way regulation valve
V 1.6		Automatic 2-way isolating valve
V 1.7		Temperature sensor as control
V 1.8		Pressure gage
V 1.9		Thermometer
V 1.10		Rinsing ball valve with plug
V 1.11		Hose line

Refrigeration Unit for Air Cooling

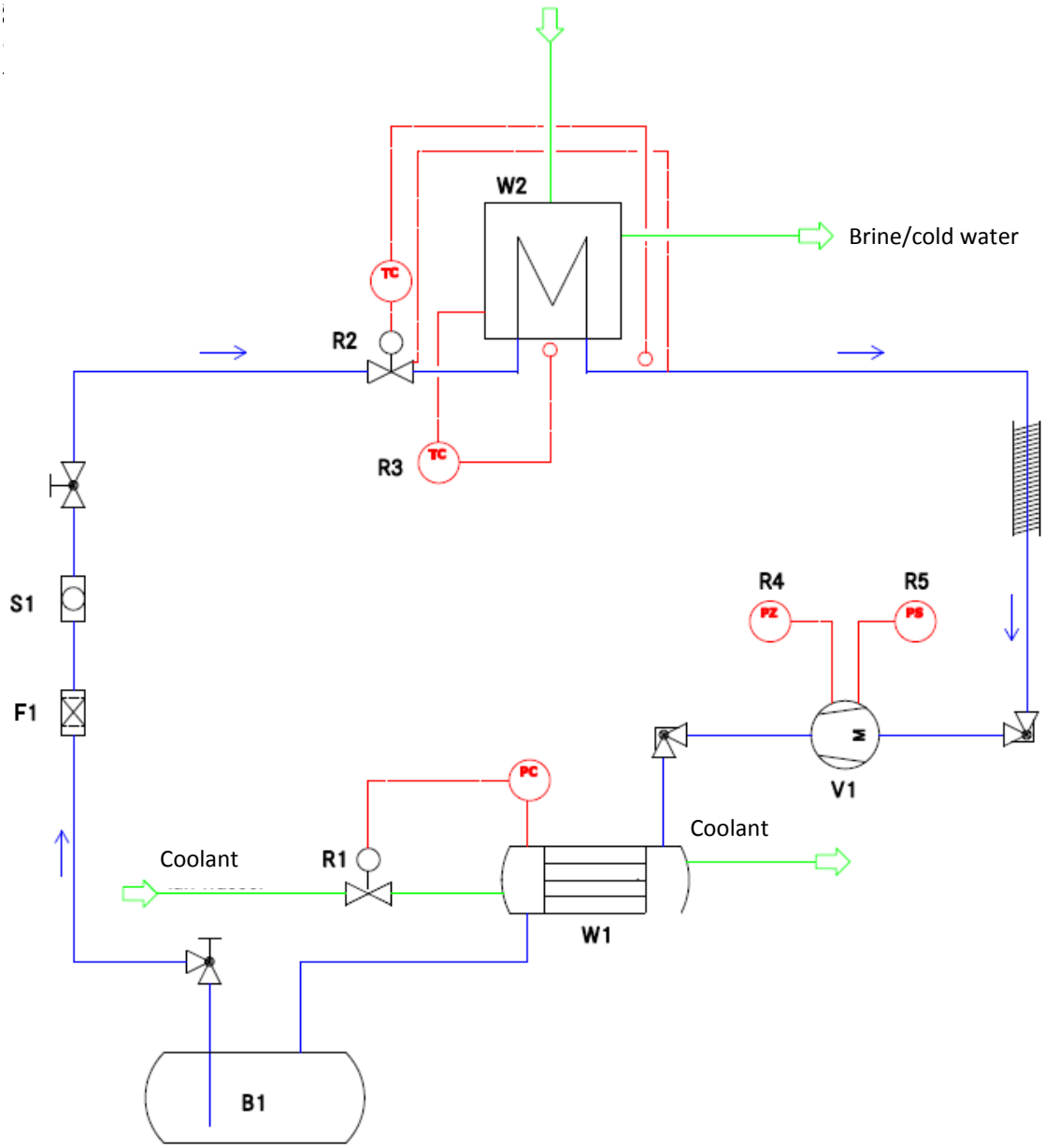
Switchgear cabinet cooling unit



Components:

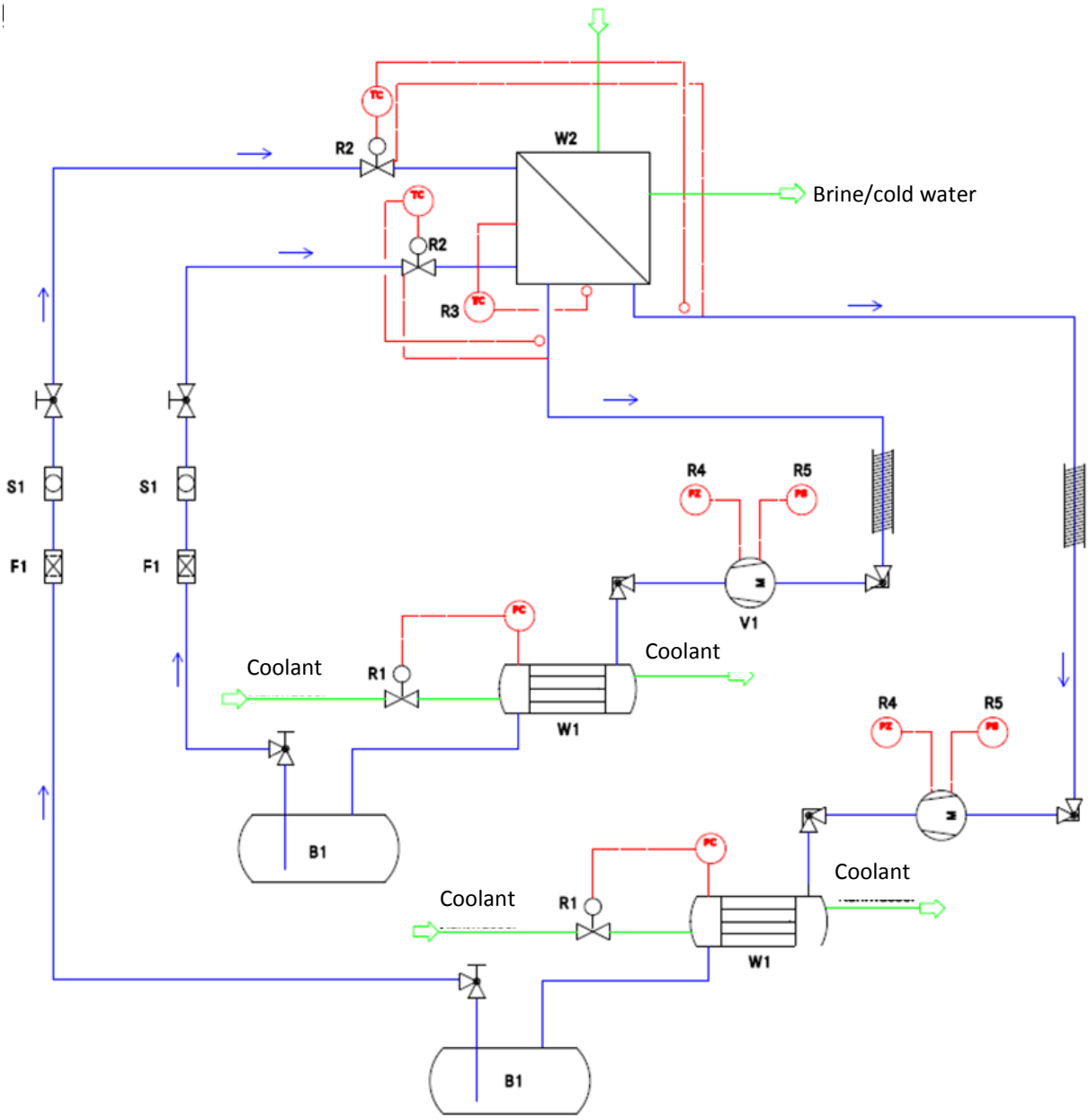
V1: Fully thermal suction-steam-cooled compressor
W1: Water-cooled shell-and-tube condenser
W2: Fin coil evaporator with fan (controlled)
B1: Refrigerant collector
R1: Coolant pressure regulator
F1: Filter drier
S1: Inspection glass
R2: Tank vent valve with external pressure compensation (injection valve)
R3: Room thermostat / cold-water thermostat
R4: High-pressure switch
R5: Low-pressure switch

Refrigeration Unit for Brine Cooling (Plate Heat Exchanger)



Components:
V1: Fully thermal suction-steam-cooled compressor
W1: Water-cooled shell-and-tube condenser
W2: Plate heat exchanger
B1: Refrigerant collector
R1: Coolant pressure regulator
F1: Filter drier
S1: Inspection glass
R2: Tank vent valve with external pressure compensation (injection valve)
R3: Room thermostat / cold-water thermostat
R4: High-pressure switch
R5: Low-pressure switch

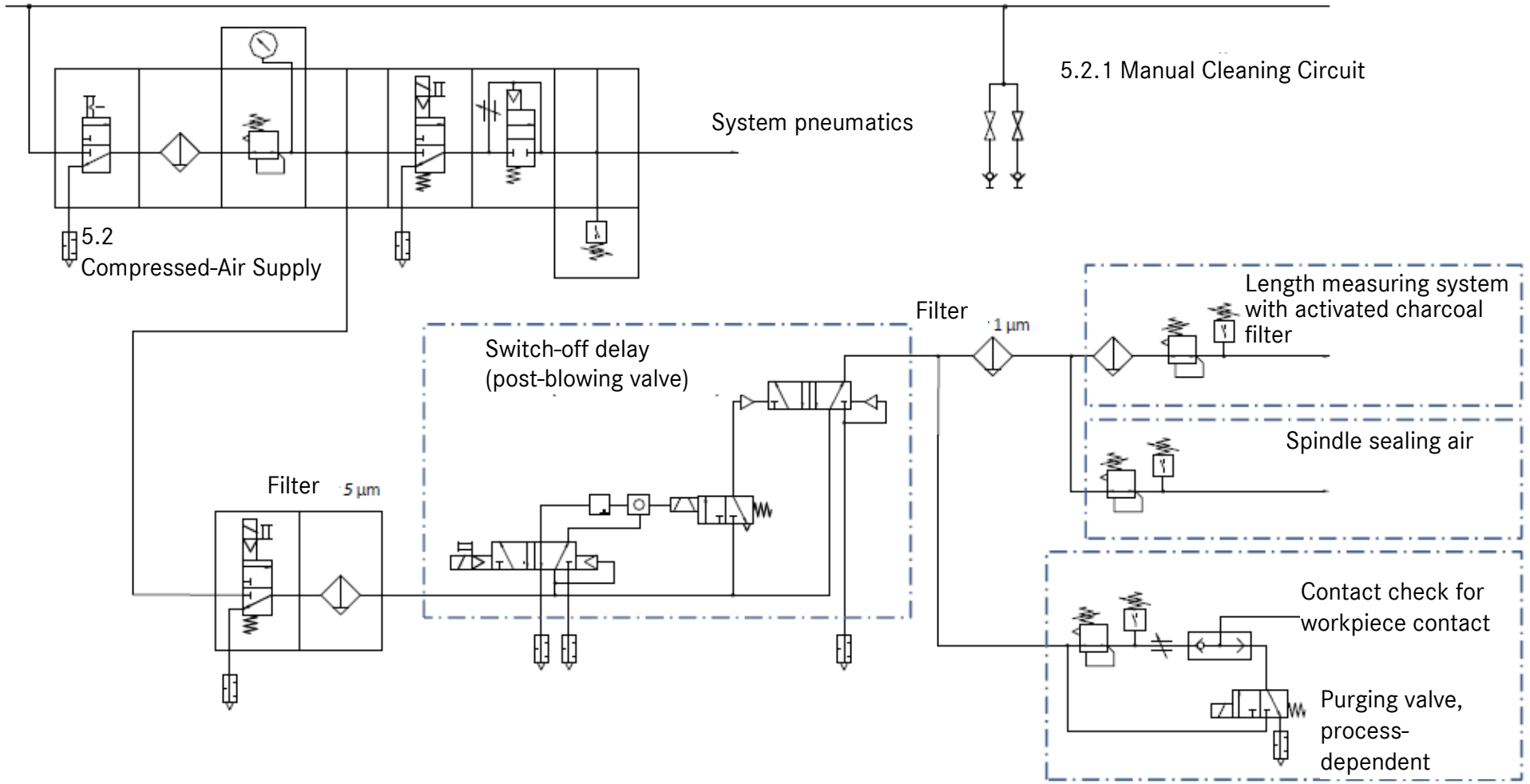
Refrigeration Unit for Brine Cooling – Plate Heat Exchanger (2 Circuits)



Components:

V1: Fully thermal suction-steam-cooled compressor
W1: Water-cooled shell-and-tube condenser
W2: Plate heat exchanger
B1: Refrigerant collector
R1: Coolant pressure regulator
F1: Filter drier
S1: Inspection glass
R2: Tank vent valve with external pressure compensation (injection valve)
R3: Room thermostat / cold-water thermostat
R4: High-pressure switch
R5: Low-pressure switch

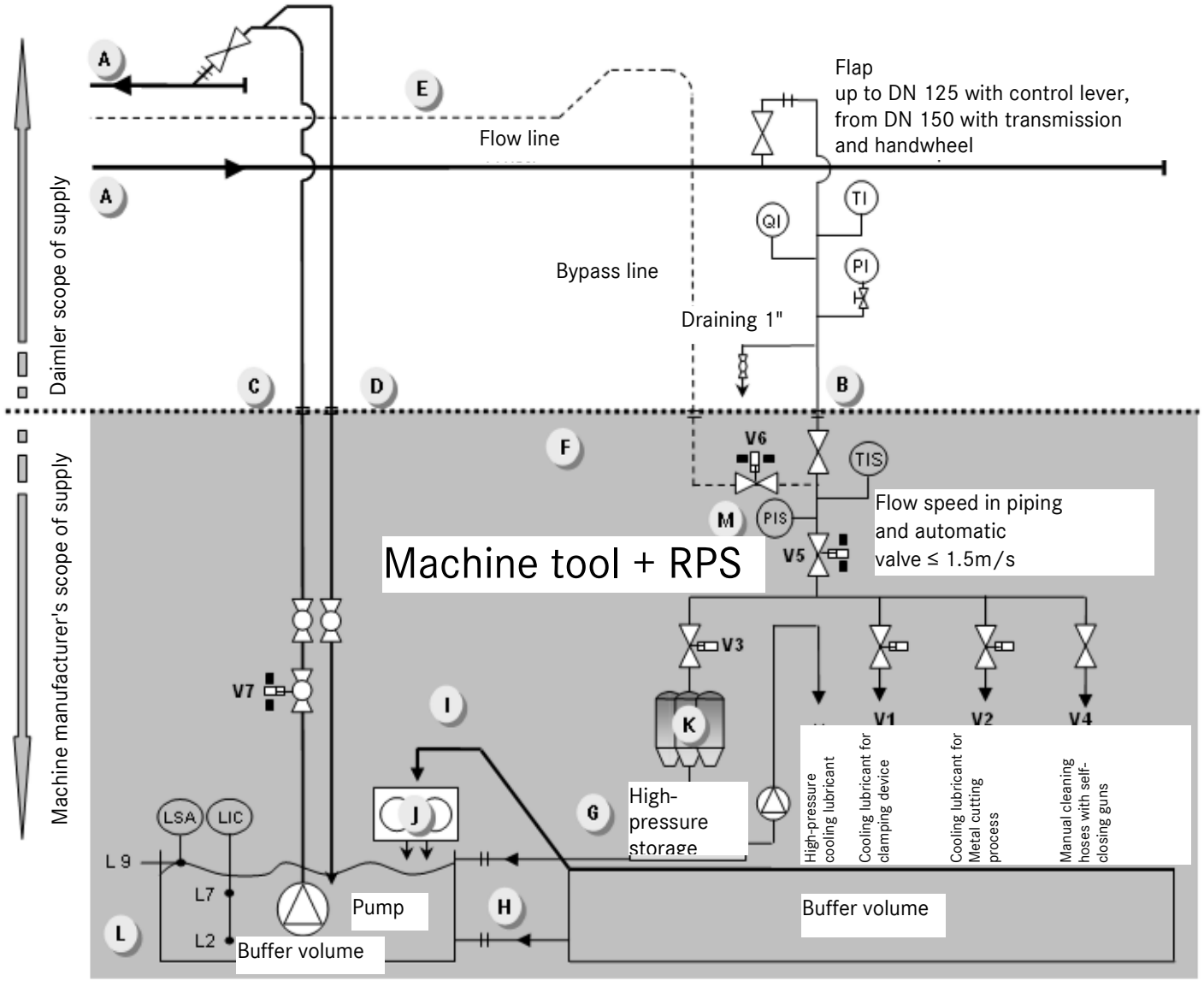
Pneumatic Compressed Air Supply (Schematic Diagram) See the MDM for the components.



5.2 Compressed-Air Supply

- Switch-on valve (manual)
- Filter regulator (40µm)
- Branch module
- Switch-on valve (electric)
- Pressure build-up valve
- Branch-off module with pressure switch

Cooling Lubricant Supply with Disposal via Return Pump Station



Daimler scope of supply:

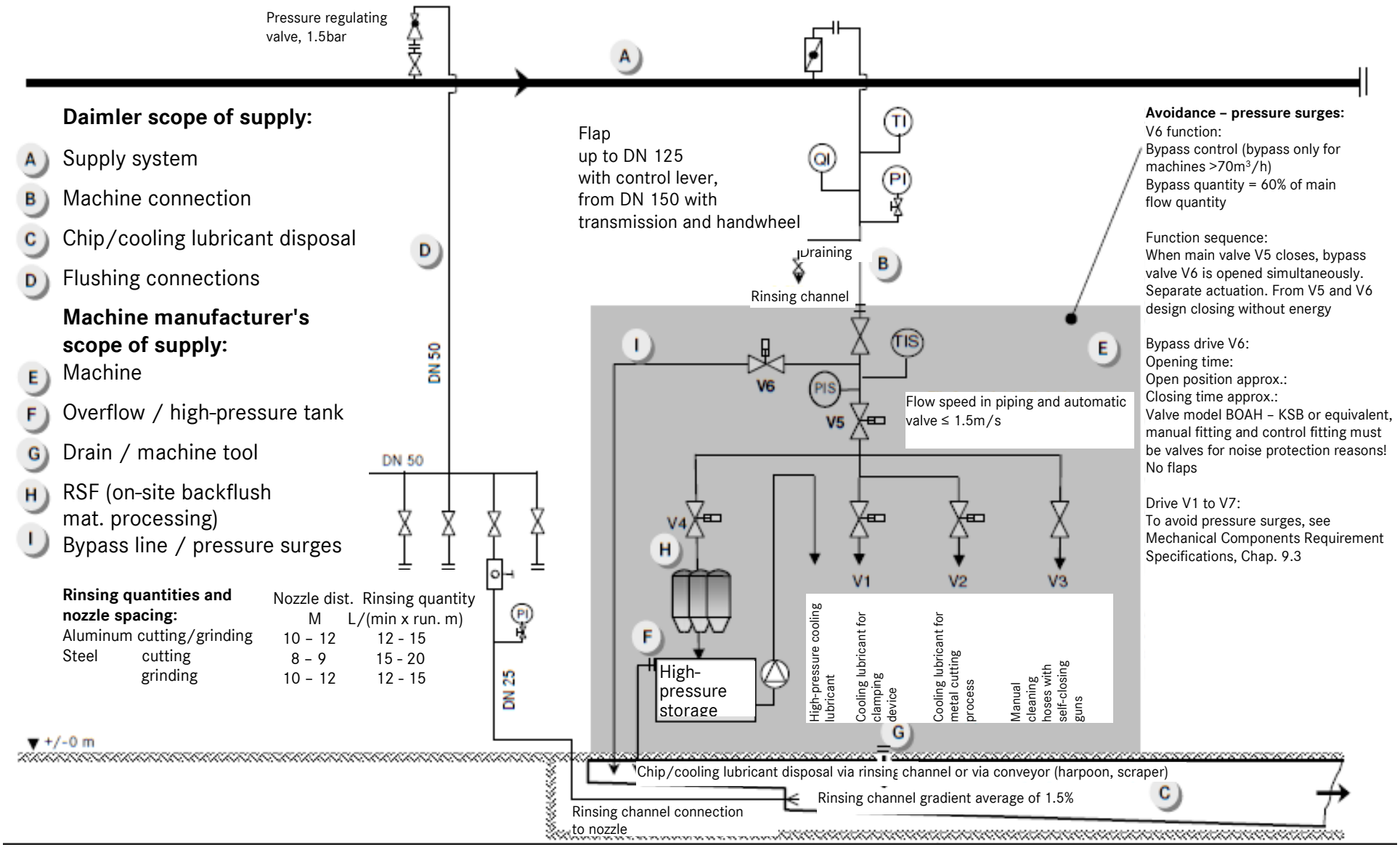
- A Feed/return
- B Machine connection
- C Return pump line
- D ¾" vent line
- E Bypass line

Machine manufacturer's scope of supply:

- F Machine tool
- G Overflow / high-pressure tank
- H Drain / mach.
- I Chip conveyor
- J Chip pulverizer if necessary
- K Reversible flow filter (on-site processing)
- L Circulating pump station
- M Bypass valve for quantities > 70m³/h
  Bypass quantity = 60% of main flow quantity

Buffer volume:
Buffer volume from machine tool and RPS must be so great that the travel volume after closing V5 can be caught incl. 10% reserve plus return flow volume, which is approximately equal to $V=(\pi/4)*DN^2*6m$.

Cooling Lubricant Supply with Disposal via Rinsing Channel

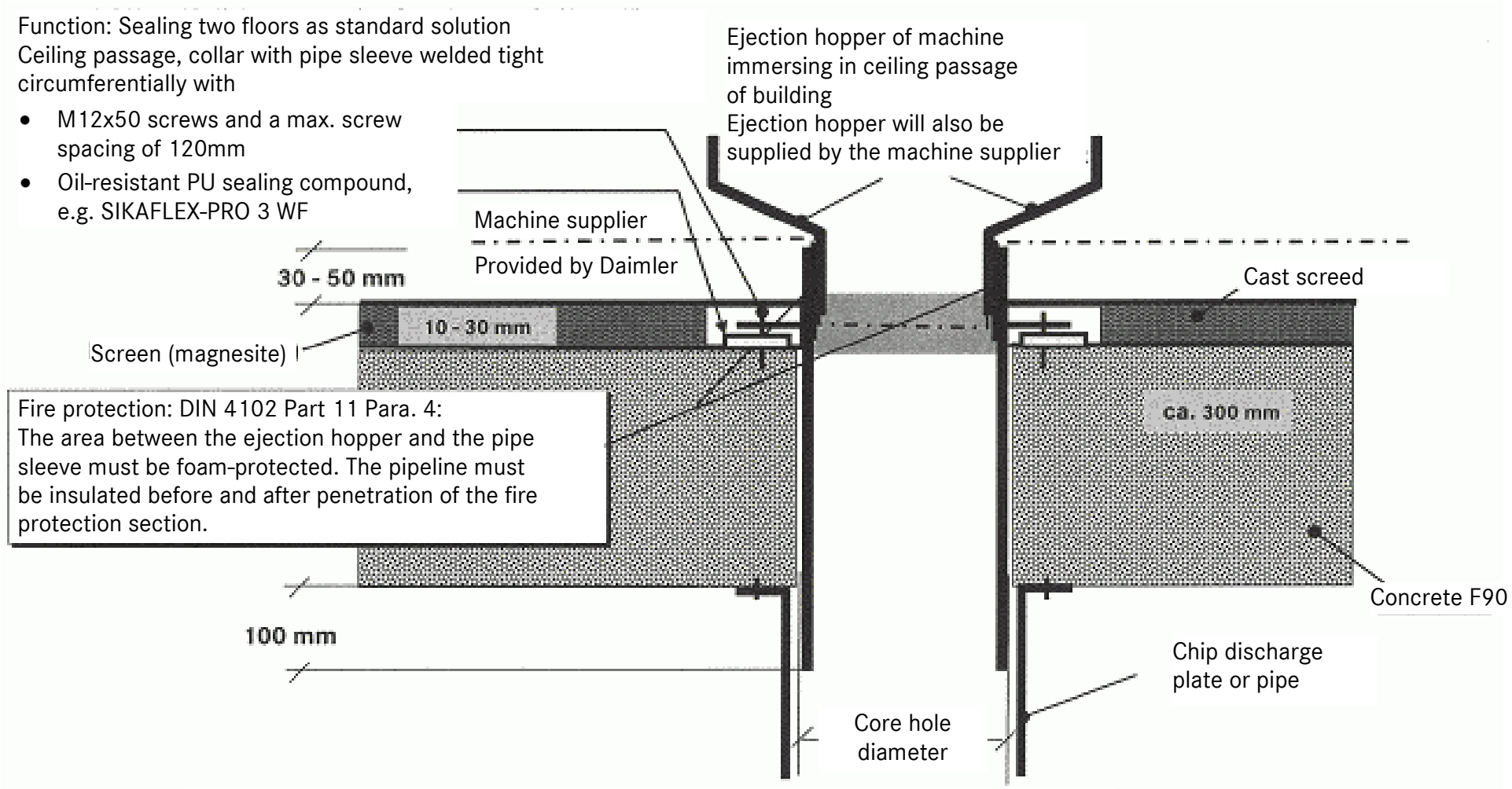


Ceiling Passage for Chip Ejector 1

Function: Sealing two floors as standard solution
Ceiling passage, collar with pipe sleeve welded tight circumferentially with

- M12x50 screws and a max. screw spacing of 120mm
- Oil-resistant PU sealing compound, e.g. SIKAFLEX-PRO 3 WF

Ejection hopper of machine immersing in ceiling passage of building
Ejection hopper will also be supplied by the machine supplier

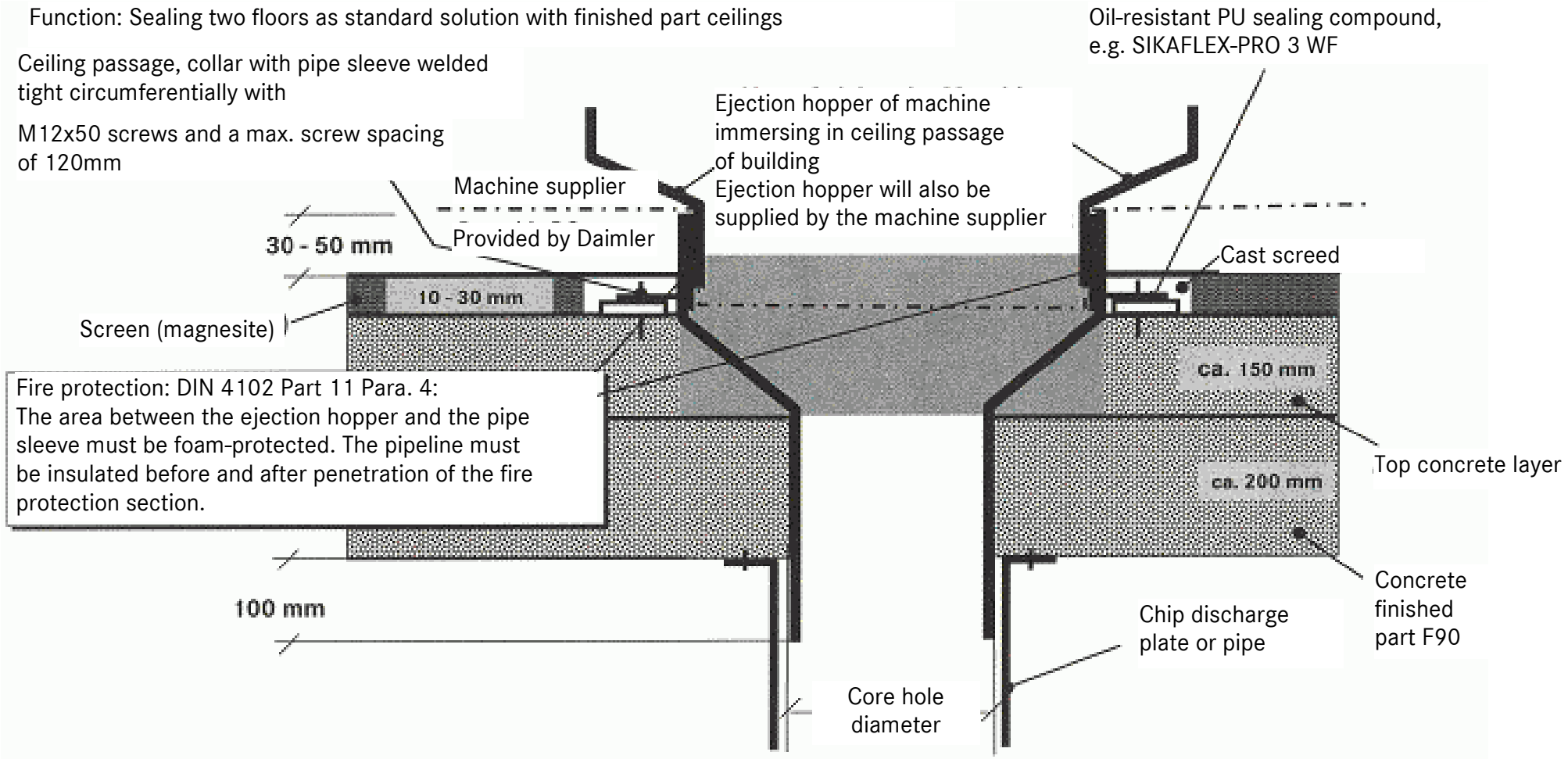


Fire protection: DIN 4102 Part 11 Para. 4:
The area between the ejection hopper and the pipe sleeve must be foam-protected. The pipeline must be insulated before and after penetration of the fire protection section.

- Core hold drill diameter for chip ejectors starting at 150mm
- Other available core hold drill diameters: 180, 200, 250, 300, 350 and 450mm
- Holes always only according to coordination with structural engineer!

Ceiling Passage for Chip Ejector 2

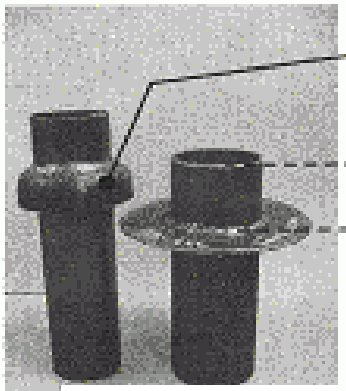
Function: Sealing two floors as standard solution with finished part ceilings



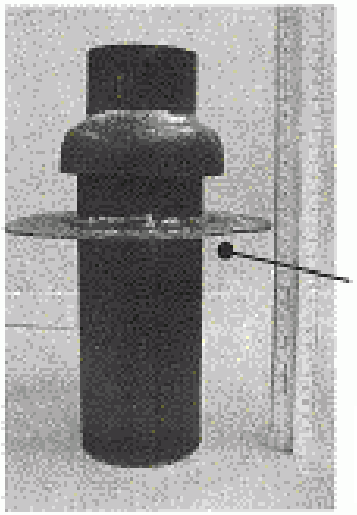
- Core hold drill diameter for chip ejectors starting at 150mm
- Other available core hold drill diameters: 180, 200, 250, 300, 350 and 450mm
- Holes always only according to coordination with structural engineer!

Ceiling Passage for Piping

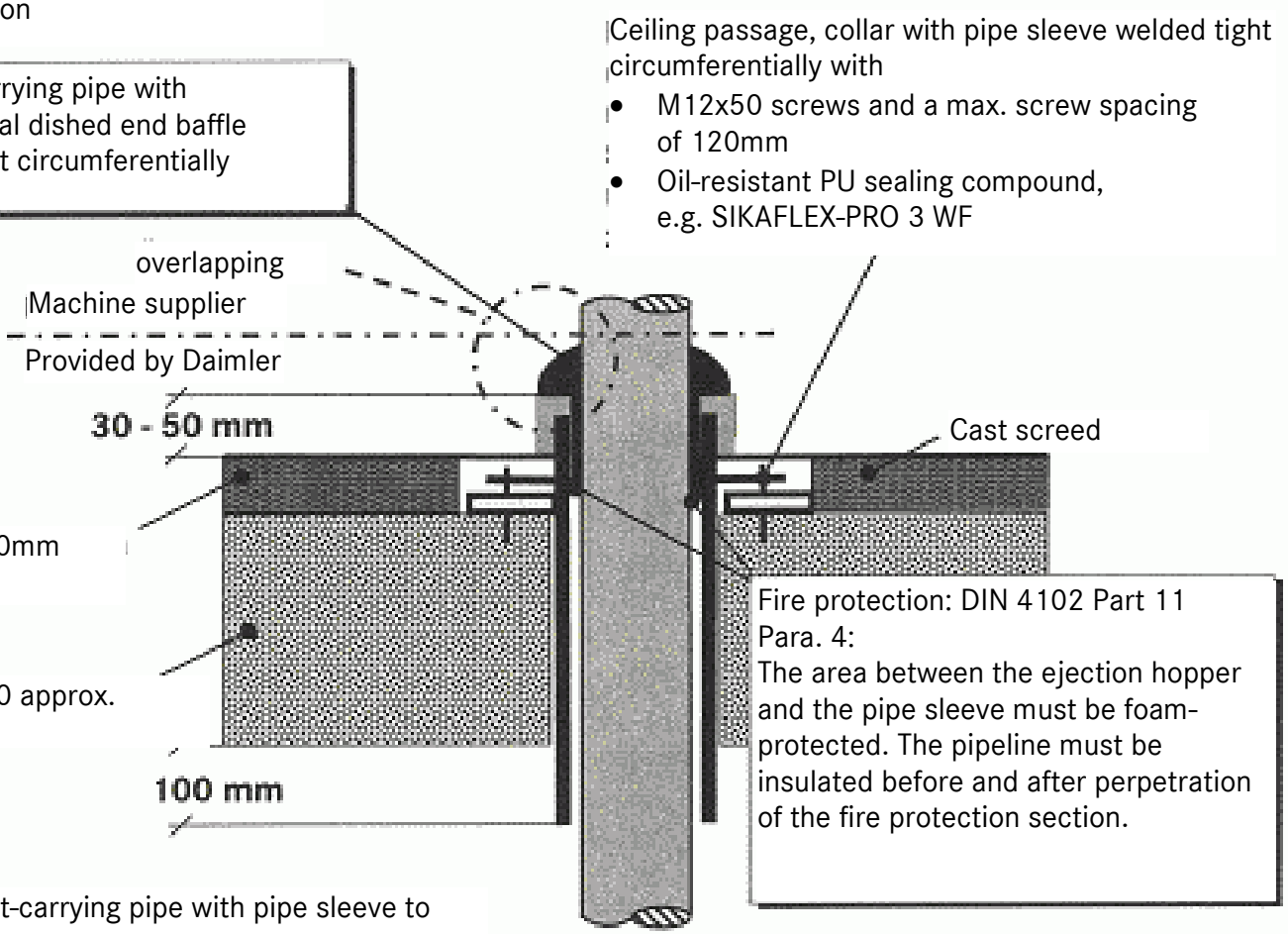
Function: Sealing two floors as standard solution



Pipe sleeve provided by Daimler

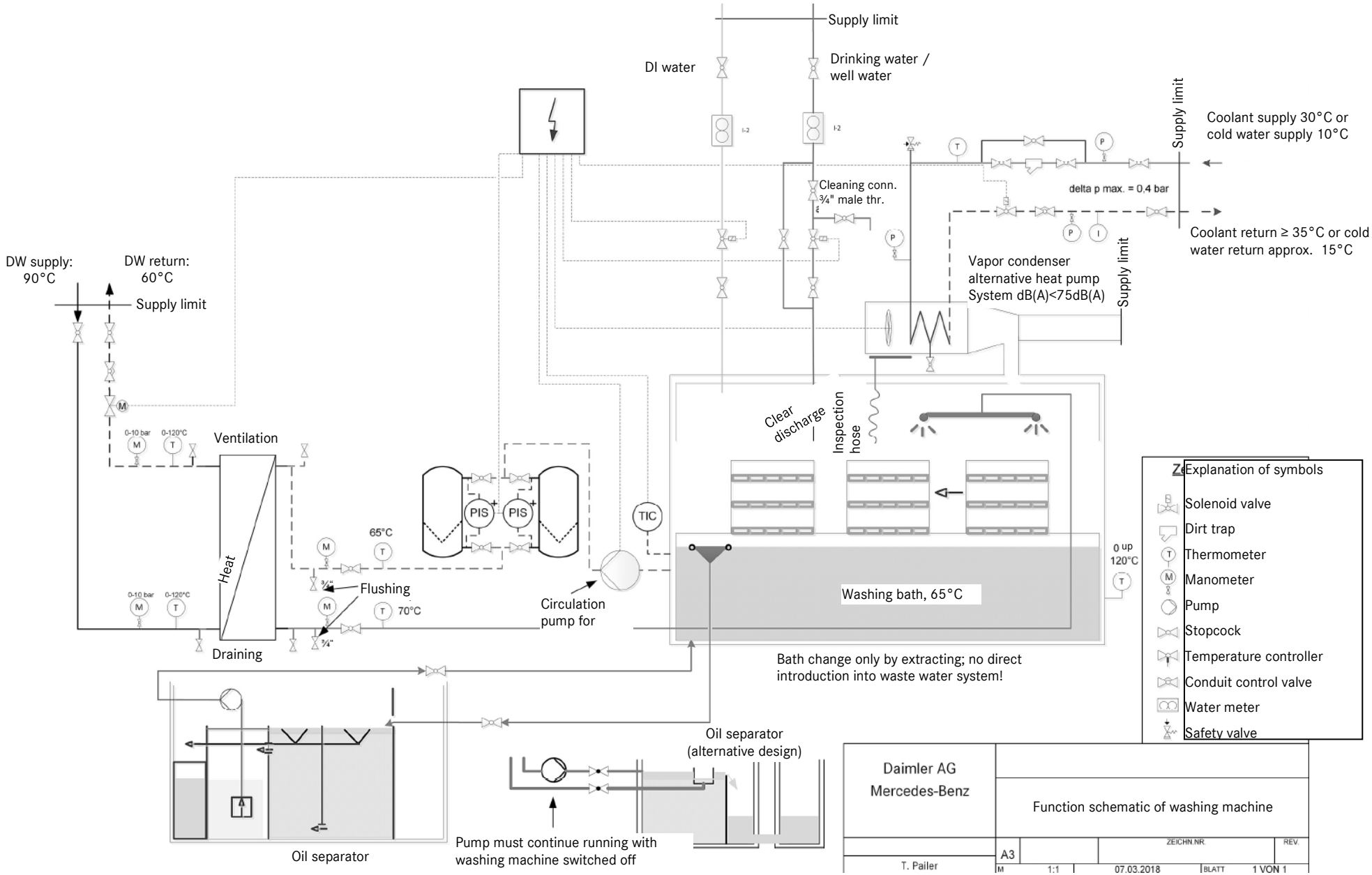


Assembly: Product-carrying pipe with pipe sleeve to ceiling passage



- Available core hold drill diameters: 76, 86, 100, 120, 150, 180, 200, 250, 300, 350 and 450mm
- Holes always only according to coordination with structural engineer!

Function Schematic of Cleaning Systems



DAIMLER

Powertrain Requirement Specifications 2020 Part 2 Mechanical Components

Appendix 14: Media Provided acc. to Plants

Version 1.0

Table of Contents

1. General Information

1.1. Record of Revisions

Version	Last revised:	Chapter:	Changed by:
1.0	24.02.2020	Appendix fully revised / newly created	Work package 2: Mechanical Components

2. Energy and Media Supply / Design Parameters

The following lists the technical data for the compressed-air supply system, coolant supply and heat supply according to the respective plants.

2.1. Plant 010 (Neckartal / Mercedes Benz Powertrain)

Compressed-air supply For compressed air supply to all machines and tools, the following parameters apply:	Operating pressure at rated pressure PN 10 interface	5.0 bar. The use of multiple consumers may result in a brief drop in air pressure. For this reason, the system shall also operate flawlessly at a pressure of 4.5 bar.
	Residual oil content	3 – 5 mg/m^3
	Oil types used	Turbine oil DIN 51515, hydraulic oil DIN 51525, condenser oil DIN51506
	Residual moisture	6 g/m^3 (behind the freeze drier)
	Dew point	Approx. +4°C
	Remarks	-
Coolant supply (open circuit, e.g. from cooling tower)	Supply temp.	tVL 10–30°C (depending on the weather conditions)
	Return flow temp.	Δtmin ≥ + 5°C (return flow minus flow)
	Pressure stage	PN 10, pressure-resistant consumers
	Perm. pressure loss at the consumer	Max. 1.5 bar
	PN 10 tVL/tRL = 110°C / 70°C	Δtmax = 10°C
***Coolant** (open circuit, e.g. from cooling tower)*	*Coordination with the representative*	*Coordination with the representative*
Cooling lubricant (KSS) (oil and emulsion)	PN 16	ΔP_{VL} ≥ 2 bar (at the machines) demand-oriented: 1. Temperature to be coordinated with the representative. 2. Filtration fineness for: - Machining 105 µm (nominal). - Grinding 60 µm (nominal). - Honing / lapping 30 µm (nominal) (residual contamination content 70 - 100 mg/l)
Washing water	PN 16	ΔP_{VL} ≥ 2 bar (at the machines), tVL is to be coordinated with Daimler department, filter fineness:100µm
Extraction	Flow rate	1. Design as per MBN 9666-2 2. Observe fire protection 3. Observe explosion protection 4. Generally engage the pertinent department when extracting aluminum and / magnesium materials.
Heat supply PN 16 with heat exchanger in production facility	Supply temp.	tVL = 110°C weekend reduction
	Return flow temp.	tRL ≤ 70°C possible depending on the relevant sub-plant
	Design temp.	135°C (for material)
	Pressure stage	-
	Remark	Bad Cannstatt plant sliding temperature: 80°C with outside temperature > 0°C up to 110°C from outside temperature - 12°C Bad Cannstatt plant sliding temperature: 80°C with outside temperature > 0°C up to 110°C from outside temperature - 12°C

2.2. Plant 040 (Berlin / Mercedes Benz Powertrain)

Compressed-air supply For compressed air supply to all machines and tools, the following parameters apply:	Operating pressure at rated pressure PN 10 interface	5.0 bar. The use of multiple consumers may result in a brief drop in air pressure. For this reason, the system shall also operate flawlessly at a pressure of 4.5 bar.
	Residual oil content	3 – 5 mg/m³
	Oil types used	Turbine oil DIN 51515, hydraulic oil DIN 51525, condenser oil DIN51506
	Residual moisture	6 g/m³ (behind the freeze drier)
	Dew point	Approx. +4°C
	Remarks	-
Coolant supply (open circuit, e.g. from cooling tower)	Supply temp.	tVL 10–30°C (depending on the weather conditions)
	Return flow temp.	Δtmin ≥ + 5°C (return flow minus flow)
	Pressure stage	PN 10, pressure-resistant consumers
	Perm. pressure loss at the consumer	Max. 1.5 bar
	PN 10 tVL/tRL = 110°C / 70°C	Δtmax = 10°C
***Coolant** (open circuit, e.g. from cooling tower)*	*Coordination with the representative*	*Coordination with the representative*
Cooling lubricant (KSS) (oil and emulsion)	PN 16	ΔPVL ≥ 2 bar (at the machines) demand-oriented: 1. Temperature to be coordinated with the representative. 2. Filtration fineness for: - Machining 105 µm (nominal). - Grinding 60 µm (nominal). - Honing / lapping 30 µm (nominal) (residual contamination content 70 - 100 mg/l)
Washing water	PN 16	ΔP_{VL} ≥ 2 bar (at the machines), tVL is to be coordinated with Daimler department, filter fineness:100µm
Extraction	Flow rate	1. Design as per MBN 9666-2 2. Observe fire protection 3. Observe explosion protection 4. Generally engage the pertinent department when extracting aluminum and / magnesium materials.
Heat supply PN 16 with heat exchanger in production facility	Supply temp.	tVL = 110°C weekend reduction
	Return flow temp.	tRL ≤ 70°C possible depending on the relevant sub-plant
	Design temp.	135°C (for material)
	Pressure stage	-
	Remark	Bad Cannstatt plant sliding temperature: 80°C with outside temperature > 0°C up to 110°C from outside temperature - 12°C Bad Cannstatt plant sliding temperature: 80°C with outside temperature > 0°C up to 110°C from outside temperature - 12°C

2.3. Plant 068 (Hamburg / Mercedes Benz Powertrain)

Compressed-air supply For compressed air supply to all machines and tools, the following parameters apply:	Operating pressure at rated pressure PN 10 interface	5.0 bar. The use of multiple consumers may result in a brief drop in air pressure. For this reason, the system shall also operate flawlessly at a pressure of 4.5 bar.
	Residual oil content	3 – 5 mg/m^3
	Oil types used	Turbine oil DIN 51515, hydraulic oil DIN 51525, condenser oil DIN51506
	Residual moisture	6 g/m^3 (behind the freeze drier)
	Dew point	Approx. +4°C
	Remarks	-
Coolant supply (open circuit, e.g. from cooling tower)	Supply temp.	tVL 10–30°C (depending on the weather conditions)
	Return flow temp.	Δtmin ≥ + 5°C (return flow minus flow)
	Pressure stage	PN 10, pressure-resistant consumers
	Perm. pressure loss at the consumer	Max. 1.5 bar
	PN 10 tVL/tRL = 110°C / 70°C	Δtmax = 10°C
***Coolant** (open circuit, e.g. from cooling tower)*	*Coordination with the representative*	*Coordination with the representative*
Cooling lubricant (KSS)(oil and emulsion)	PN 16	ΔPVL ≥ 2 bar (at the machines) demand-oriented: 1. Temperature to be coordinated with the representative. 2. Filtration fineness for: - Machining 105 µm (nominal). - Grinding 60 µm (nominal). - Honing / lapping 30 µm (nominal) (residual contamination content 70 - 100 mg/l)
Washing water	PN 16	ΔP_{VL} ≥ 2 bar (at the machines), tVL is to be coordinated with Daimler department, filter fineness:100µm
Extraction	Flow rate	1. Design as per MBN 9666-2 2. Observe fire protection 3. Observe explosion protection 4. Generally engage the pertinent department when extracting aluminum and / magnesium materials.
Heat supply PN 16 with heat exchanger in production facility	Supply temp.	tVL = 110°C weekend reduction
	Return flow temp.	tRL ≤ 70°C possible depending on the relevant sub-plant
	Design temp.	135°C (for material)
	Pressure stage	-
	Remark	Bad Cannstatt plant sliding temperature: 80°C with outside temperature > 0°C up to 110°C from outside temperature - 12°C Bad Cannstatt plant sliding temperature:80°C with outside temperature > 0°C up to 110°C from outside temperature - 12°C

2.4. Plant 020 (Mannheim / Daimler Truck)

Compressed-air supply For compressed air supply to all machines and tools, the following parameters apply:	Operating pressure at rated pressure PN 10 interface	5.0 bar. The use of multiple consumers may result in a brief drop in air pressure. For this reason, the system shall also operate flawlessly at a pressure of 4.5 bar.
	Residual oil content	Correspondingly aspirated outside air, because oil-free compression
	Oil types used	.
	Residual moisture	See dew point
	Dew point	approx. +3°C pressure dew point
	Remarks	-
Coolant supply (open circuit, e.g. from cooling tower)	Supply temp.	tVL 10–30°C (depending on the weather conditions)
	Return flow temp.	Δtmin ≥ + 5°C (return flow minus flow)
	Pressure stage	PN 10, pressure-resistant consumers
	Perm. pressure loss at the consumer	Max. 1.5 bar
	PN 10 tVL/tRL = 110°C / 70°C	Δtmax = 10°C
***Coolant** (open circuit, e.g. from cooling tower)*	*Coordination with the representative*	*Coordination with the representative*
Cooling lubricant (KSS0) (oil and emulsion)	PN 16	ΔPVL ≥ 2 bar (at the machines) demand-oriented: 1. Temperature to be coordinated with the representative. 2. Filtration fineness for: Machining 105 µm (nominal). Grinding 60 µm (nominal). Honing / lapping 30 µm (nominal) (residual contamination content 70 - 100 mg/l)
Washing water	PN 16	$\Delta P_{VL} \geq$ 2 bar (at the machines), tVL is to be coordinated with Daimler department, filter fineness:100µm
Extraction	Flow rate	1. Design as per MBN 9666-2 2. Observe fire protection 3. Observe explosion protection 4. Generally engage the pertinent department when extracting aluminum and / magnesium materials.
Heat supply PN 16 with heat exchanger in production facility	Supply temp.	Minimum + 80°C in summer, sliding up to + 110°C in winter
	Return flow temp.	< 50°C
	Design temp.	135°C (for material)
	Pressure stage	Max. operating pressure 10 bar
	Remark	a) The return flow temperatures in the entire heating network of the plant shall be < + 50°C. The consumers shall be equipped with return flow temperature limits.b) No overflow permissible between the flow and return flow.c) No three-way valves permissible, through-way valves only.

2.5. Plant 030 (Gaggenau / Daimler Truck)

Compressed-air supply For compressed air supply to all machines and tools, the following parameters apply:	Operating pressure at rated pressure PN 10 interface	5.0 bar. The use of multiple consumers may result in a brief drop in air pressure. For this reason, the system shall also operate flawlessly at a pressure of 4.5 bar.
	Residual oil content	
	Oil types used	
	Residual moisture	
	Dew point	
	Remarks	Air quality according to ISO 8573.1, class 3
Coolant supply (open circuit, e.g. from cooling tower)	Supply temp.	tVL 10–30°C (depending on the weather conditions)
	Return flow temp.	Δtmin ≥ + 5°C (return flow minus flow)
	Pressure stage	PN 10, pressure-resistant consumers
	Perm. pressure loss at the consumer	Max. 1.5 bar
	PN 10 tVL/tRL = 110°C / 70°C	Δtmax = 10°C
***Coolant** (open circuit, e.g. from cooling tower)*	*Coordination with the representative*	*Coordination with the representative*
Cooling lubricant (KSS) (oil and emulsion)	PN 16	ΔPVL ≥ 2 bar (at the machines) demand-oriented: 1. Temperature to be coordinated with the representative. 2. Filtration fineness for: - Machining 105 µm (nominal). - Grinding 60 µm (nominal). - Honing / lapping 30 µm (nominal) (residual contamination content 70 - 100 mg/l)
Washing water	PN 16	$\Delta P_{VL} \geq$ 2 bar (at the machines), tVL is to be coordinated with Daimler department, filter fineness:100µm
Extraction	Flow rate	1. Design as per MBN 9666-2 2. Observe fire protection 3. Observe explosion protection 4. Generally engage the pertinent department when extracting aluminum and / magnesium materials.
Heat supply PN 16 with heat exchanger in production facility	Supply temp.	tVL = 90°C
	Return flow temp.	tRL ≤ 60°C
	Design temp.	130°C (for material)
	Pressure stage	PN 16
	Remark	Operating pressure 4-8 bar

2.6. Plant 034 (Raststatt / Daimler Truck)

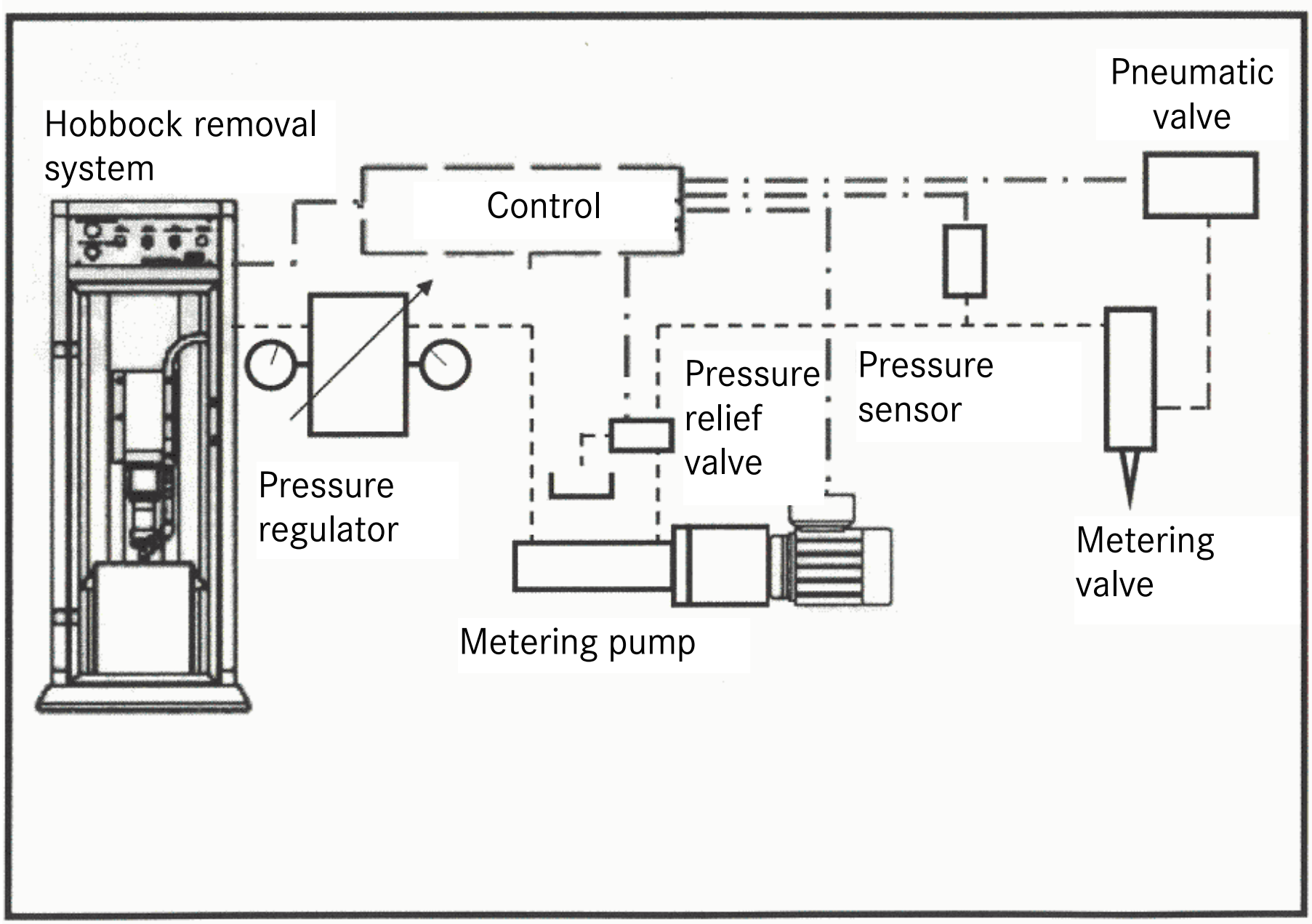
Compressed-air supply For compressed air supply to all machines and tools, the following parameters apply:	Operating pressure at rated pressure PN 10 interface	5.0 bar. The use of multiple consumers may result in a brief drop in air pressure. For this reason, the system shall also operate flawlessly at a pressure of 4.5 bar.
	Residual oil content	3 – 5 mg/m³
	Oil types used	Turbine oil DIN 51515, hydraulic oil DIN 51525, condenser oil DIN51506
	Residual moisture	6 g/m³ (behind the freeze drier)
	Dew point	Approx. +4°C
	Remarks	Air quality according to ISO 8573.1, class 4
Coolant supply (open circuit, e.g. from cooling tower)	Supply temp.	tVL 10–30°C (depending on the weather conditions)
	Return flow temp.	Δtmin ≥ + 5°C (return flow minus flow)
	Pressure stage	PN 10, pressure-resistant consumers
	Perm. pressure loss at the consumer	Max. 1.5 bar
	PN 10 tVL/tRL = 110°C / 70°C	Δtmax = 10°C
***Coolant** (open circuit, e.g. from cooling tower)*	*Coordination with the representative*	*Coordination with the representative*
Cooling lubricant (KSS) (oil and emulsion)	PN 16	ΔPVL ≥ 2 bar (at the machines) demand-oriented: 1. Temperature to be coordinated with the representative. 2. Filtration fineness for: - Machining 105 µm (nominal). - Grinding 60 µm (nominal). - Honing / lapping 30 µm (nominal) (residual contamination content 70 - 100 mg/l)
Washing water	PN 16	ΔP_{VL} ≥ 2 bar (at the machines), tVL is to be coordinated with Daimler department, filter fineness:100µm
Extraction	Flow rate	1. Design as per MBN 9666-2 2. Observe fire protection 3. Observe explosion protection 4. Generally engage the pertinent department when extracting aluminum and / magnesium materials.
Heat supply PN 16 with heat exchanger in production facility	Supply temp.	tVL = 90°C
	Return flow temp.	tRL ≤ 60°C
	Design temp.	130°C (for material)
	Pressure stage	PN 16
	Remark	4–8 bar (Rastatt sub-plant: 3.0 bar)

2.7. Plant 069 (Kassel / Daimler Truck)

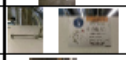
Compressed-air supply For compressed air supply to all machines and tools, the following parameters apply:	Operating pressure at rated pressure PN 10 interface	5.0 bar. The use of multiple consumers may result in a brief drop in air pressure. For this reason, the system shall also operate flawlessly at a pressure of 4.5 bar.
	Residual oil content	Correspondingly aspirated outside air, because oil-free compression
	Oil types used	
	Residual moisture	See dew point
	Dew point	approx. +4°C pressure dew point
	Remarks	-
Coolant supply (open circuit, e.g. from cooling tower)	Supply temp.	tVL 10–30°C (depending on the weather conditions)
	Return flow temp.	Δtmin ≥ + 5°C (return flow minus flow)
	Pressure stage	PN 10, pressure-resistant consumers
	Perm. pressure loss at the consumer	Max. 1.5 bar
	PN 10 tVL/tRL = 110°C / 70°C	Δtmax = 10°C
Coolant *(open circuit, e.g. from cooling tower)*	*As coordinated*	*Coordination with the representative*
Cooling lubricant (KSS) (oil and emulsion)	PN 16	ΔPVL ≥ 2 bar (at the machines) demand-oriented: 1. Temperature to be coordinated with the representative. 2. Filtration fineness for: - Machining 105 µm (nominal). - Grinding 60 µm (nominal). - Honing / lapping 30 µm (nominal) (residual contamination content 70 - 100 mg/l)
Washing water	PN 16	$\Delta P_{VL} \geq$ 2 bar (at the machines), tVL is to be coordinated with Daimler department, filter fineness:100µm
Extraction	Flow rate	1. Design as per MBN 9666-2 2. Observe fire protection 3. Observe explosion protection 4. Generally engage the pertinent department when extracting aluminum and / magnesium materials.
Heat supply PN 16 with heat exchanger in production facility	Supply temp.	tVL a) 100°C up to max. 120°C for industrial and process heat consumers b) Building heating 60°C to 100°C sliding
	Return flow temp.	tRL ≤ 70°C a) The return flow temperatures in the entire heating network of the plant shall be < max. + 68 °C. To this end all consumers shall be equipped with return flow temperature limiters guaranteeing max. permissible return flow temperatures in all operating states.b) No overflow or short-circuit tracks permissible between the flow and return flow.
	Design temp.	120°C for material in entire plant network
	Pressure stage	PN 16
	Remark	Δp consumer: < 0.5 bar, plant network and consumer network separated by heat exchanger

3. Abbreviations

Silicone Coating – Schematic Diagram



Decision Matrix: "Accessible Machines, Lifting Platforms and Platforms"

Bsp.	Fall	Häufigkeit		Zugang - Aufstieg						Zugangs-absicherung		Podest			Bemerkung	Ausführungs-beispiel
	Begehbare Maschinen, Bühnen und Podeste	regelmäßig	unregelmäßig	feste Treppe	Stufen- / Anlegeleiter z. Einhängen	Treppenleiter (Stiegleiter)	Podestleiter, Montagebühne	Knickarmbühne	Wartungs- / Montagebühne (z.B. mit ausschiebbarer Plattform)	Geringe Gefährdung => Pendelklappe (=selbstschließende Durchgangssperre) + Sicherheitskennzeichnung	hohes Gefährdungspotential => vollständige Tür mit elekt. Absicherung	Rutschsicherheit i.dR. Gitterroste R12 s. Lastenheft Teil II, GA-mu01	dreistufiges Geländer	Anschlagpunkte	**Grundsatz:** Hersteller schafft Zugangsmöglichkeiten damit alle Betätigungen, einschl. Rüsten und Instandhaltung sicher erreicht werden können. Die Rangfolge von Sicherheitsmaßnahmen sind zu berücksichtigen (technisch vor organisatorisch vor personell) Konstruktion so, dass weitestgehend alle Routinetätigkeiten vom Boden aus durchzuführen sind. Wenn C-Normen vorliegen sind diese der Mindeststandard.	
0.	**Fallbeispiel / Ausführungsart**															
1.	**Maschinen**															
1.1.	*Bedienung, Betrieb*	X		■						■	O	■	■			
1.2.	Wartung (Maschinenbediener)	X	X				■								Podesthöhe < 2 m. Übersteigen verboten. Dito Bockleiter!	
1.3.	Störungsbeseitigung u. -beobachtung		X		■	○	○	□	□	■	○	■	■			
1.4.	Vorbeugende Instandhaltung auf der Maschine	X		■	○	○	○	□	□	■	○	■	■			
1.5.	Reparatur		X	○	○	○	○	■	□	■	○	■	■	○		
2.	**Verkettungen (Transfer + Portale)**															
2.1.	Wartungspunkt Obertransfer (Wartung)	X				○	■	○	□	□	○	■	■	■	Podest U-/L-förmig um Wartungskopf. Erreichbarkeit notwendiger Stellen. Podestbreite 0,8 m. Absturzabsicherung zum Lader z.B. schieb-/steckbares Geländer	
2.2.	Reparatur Obertransfer (Instandsetzung auf halber Strecke)		X				○	■	○	○	■	■	■			
3.	**Hochbänder, -strecken**															
3.1.	Zugangshöhe bis 3m (Wartung und Instandsetzung)	X	X				■								An schwer erreichbaren Stellen Podeste vorsehen. **Ggfs. Trenngitter**	
3.2.	Zugangshöhe ab 3m (Wartung)	X		■							○	■	■	○	2. Abgang bei Strecken ab 15 m. max. Entfernung 35 m Umkreis.	
3.3.	Zugangshöhe ab 3m (Instandsetzung)		X	■							○	■	■	○	2. Abgang bei Strecken ab 15 m. max. Entfernung 35 m Umkreis.	
4.	**IH-Ebenen/-Bereiche**															
4.1.	Instandhaltungsebenen	X	X	■		○					■	■			Beachtung AS-Guideline "Fördertechnik", siehe Lastenheft	
4.2	Heberschächte (maschinenintegriert)		X		○	■	○				□		○	■	Es sind Zugänglichkeiten für Wartung und Instandhaltung zu schaffen z.B. Anwendungsfall: Heber bleibt auf halber Strecke hängen.	
4.3	Roboterdurchreichen in HIKO-Ebenen		X	■							■	■	■	■	2 m vor Absturzstellen sind Warnportale nach Guideline Arbeitssicherheit, Kapitel Fördertechnik vorzusehen + ergänzend liegende Lichtgitter (berührungslose Absicherung nach IS0 10218) zur Absicherung des Automatikbetriebs + ggf. einschiebbare, elektrisch abgesicherte Wartungsebene für Instandhalter	
4.4	Roboterinstandhaltung		X	■					□			■	■		Ab einer Sockelhöhe > 500 mm ist eine Stand- und Aufstiegsmöglichkeit vorzusehen. Alternativ: Einbringen einer mobilen, TÜV-geprüften Arbeitsbühne / Arbeitsplattform nach Abstimmung mit Fachbereich Robotik und Arbeitssicherheit in der Planungsphase	
4.5	Kranbahn-Laufstege		X	■							□	○	■	○	Tür mit Schließung für Kraninstandhaltung (ohne elektrische Absicherung), Panikschließung, Türschließer und Zutrittsverbotskennzeichnung	
4.6	Regale/Speicher	X	X				■				■	○	■	○	Anlagen nach Maschinenrichtlinie und ggf. C-Norm beschaffen	

Coordination with the representative

Decision Matrix: "Accessible Machines, Lifting Platforms and Platforms"

Ex.	Case	Frequency		Access - steps:						Access protection		Platform			Comment	Implementation example
	Accessible machines, lifting platforms and platforms	Regular	Irregular	Fixed stairway	Steps/simple ladder to hook in	Stepped ladder (vertical ladder)	Platform ladder, assembly platform	Articulated arm platform	Maintenance /assembly platform (e.g. with platform that can be extended)	Low risk => pendulum cap (=< self-closing barrier) + safety marking	High risk potential => complete door with elect. protection	Non-slip surface, usually gratings R12, see requirement specifications Part II, GA-mu01	Three-step railing	Attachment points	Principle: Manufacturer creates access possibilities so that all operations, including setup and maintenance can be achieved safely. The ranking of safety measures shall be taken into account (technical before organizational before personnel) Design so that all routine activities can be extensively performed from the floor. If there are C-standards, they are the minimum standard	
0.	**Case example / version**															
1.	**Machines**															
1.1	Controls, operation															
1.2	Maintenance (machine operator)														Platform height < 2 m. Crossing forbidden. Ditto double ladder!	
1.3	Fault elimination and monitoring															
1.4	Preventive maintenance on the machine															
1.5	Repair															
2.	**Daisy chains (transfer + portals)**															
2.1	Overhead transfer maintenance point (maintenance)														U-/L-shaped platform around maintenance head. Accessibility of necessary positions. Platform width 0.8 m. Fall protection for loading, e.g. pushable/ insertable railings	
2.2	Overhead transfer repair (repair halfway)															
3.	**Elevated conveyors, sections**															
3.1	Access height to 3m (maintenance and repairs)														Provide platforms at positions that are difficult to reach. If necessary, separator grids	
3.2	Access height from 3m (maintenance)														2nd output for sections from 15 m. max. distance 35 m perimeter.	
3.3	Access height from 3m (repair)														2nd output for sections from 15 m. max. distance 35 m perimeter.	
4.	**Maintenance levels/areas**															
4.1	Maintenance levels														Observance of OHS Guideline (Occupation Safety) "Materials Handling Technology", see requirement specifications	
4.2	Lift shafts (integrated in the machine)														Accessibility for maintenance shall be created, e.g. use case: lift becomes stuck half way.	
4.3	Robot reach-throughs at auxiliary structure levels														Warning portals shall be planned 2 m ahead of falling points according to the Work Safety Guideline, chapter on materials handling technology + additionally recumbent light grids (contactless protection according to ISO 10218) to safeguard automatic mode + if necessary, retractable, electrically protected maintenance level for maintenance personnel	
4.4	Robot maintenance														As of a base height of > 500 mm, a standing and climbing option shall be planned. Alternatively: Integration of a mobile, TÜV-tested work platform subject to coordination with the specialist unit for robotics and work safety in the planning phase	
4.5	Gantry catwalks														Door with locking mechanism for crane maintenance (without electric safeguard), panic closing, door striker, and no unauthorized access sign	
4.6	Shelves/stores														Procure systems according to the Machinery Directive and C standard if necessary	

Explanations on Decision Matrix: "Accessible Machines, Lifting Platforms and Platforms"

Last revised: 02.02.2018

Legend:	
X	Frequency characteristic
■	Design recommended by PT/SUM and Maintenance ~~the production center~~
O	Possible variant
□	Approved, exceptional cases only

Comment regarding cell:

C1/D1

Frequency

The frequency is to be defined according to actual use, not per user group.

C2

Regular

I.e: At least weekly cycle or all affected faculties foreseeably and several times per month (operator, maintenance "electrical system, mechanical system, ventilation", CC/TSFM1, fire protection/security staff, ...).

D2

Irregular

I.e.: Unforeseeable or foreseeable for all those affected in large cycles (monthly or even larger cycles).

E1-J1

Access – steps: Basis DIN EN ISO14122-X

Always giving consideration to whether tool and/or material transport is required.

E2

Fixed stairway

Basis: standard design ~~e.g.~~ as per DIN EN ISO 14122-3

F2

Step/simple ladder to hook in

Design: Handrail/ladder spar at least 1 m over platform lower edge or pre-platform with handrail/spar.
~~Suppliers e.g. Zarges, Günzburger Steigtechnik, etc.~~
Attention: Ladders must be kept under lock and key. Provide standing space in planning.

G2

Stepped ladder (vertical ladder)

Steps according to Workplace Risk Assessment GA-mu01, from p. 24. At least step edge. Always design platform surface as 1st step. Avoidance of stumbling points between ladder attachment and platform surface.

Safety cage ~~exclusively as of a fall height of 5 m~~ starting ~~from~~ between 2.2 and 3 m above the ground. Basis: DIN EN ISO 14122-4

R2

Platform ladder, assembly platform

Attention: Platform ladders must be kept under lock and key. Provide standing space in planning.

If components > 10 kg have to be exchanged, platform ladders must be provided for two persons and increased loads.

Articulated platform and maintenance/assembly platform (with extendable platform)

I2/J2

~~Possible from the point of view of PT/SUM and~~ generally under consideration of the following notes and prerequisites:

- Elevating work platforms are considered dangerous machines in the sense of the Machinery Directive
- Only irregular i.e. occasional access is required
- Prohibition of "working under voltage" and usually welding
- Prohibition of material transport and attaching loads
- Selection of suitable persons; verification of capability; familiarization per device, specific instruction; industrial medicine checkups; minimum age 18 years
- Regular testing of operating equipment that is subject to ~~mandatory testing~~
- Written risk assessment from the manufacturer ~~risk description~~ is available.
- Suitable spatial conditions on site and availability given.
- Prohibition of misconduct
- All persons on the platform use personal protective equipment to prevent falling

Definition: Use only in the case of irregular maintenance work

~~K1/L1~~ ~~Access protection:~~

~~Basis:~~

~~Final report from the German automotive industry working group "Safety of Automated Conveyor Systems" from 2008-01, Low-Risk Conveyor Systems~~

~~These conveying systems can be erected in an adequately safe manner by means of an inherently safe design and via technical and supplementary safety measures. The remaining risks are low or exist only in the case of conscious or desired (mis-)use (e.g. ignoring an access ban; additionally consciously accepting the risk of injury)~~

~~Prerequisite of personal safety: Normal attentiveness, natural, human reactions.~~

~~L2~~

~~**High risk potential => complete safety door with elect. Validation**~~

~~Basis: Concluding report from the German automotive industry working group "Safety of Automated Conveying Systems" from 2008-01~~

~~Conveying systems with high risk~~

~~These conveying systems can only be erected in a safe manner to a limited degree by means of an inherently safe design and via technical and supplementary safety measures. The remaining endangerment for specially qualified personnel is countered by corresponding user information and personnel selection.~~

~~Prerequisite of personal safety: Constant attentiveness (In the same manner as pedestrians at a heavily used intersection)~~

~~Specially qualified personnel:~~

~~Via corresponding training and experience and special instruction, this person reveals the behavior required for safely using the materials handling technology. Own decisions must be made in this case.~~

M1-O1 Platform:

Attachment points

O2

If a simple technical option can be implemented (e.g. railing), this simple technical safeguard (e.g. railing) shall be implemented as a safety option (basis: Machinery Directive and legal ranking of safety measures (STOP model). Under all circumstances, this takes priority over protecting against falling via attaching points and personal safety equipment.

Additional aspects include:

- "Unintentional behavior" according to DIN ISO 12100-1 shall be taken into account (lack of concentration, inattentiveness, paths of least resistance, behavior under pressure, the machine shall be kept operational under all circumstances). In practice, these factors lead to the fact that the ~~belts~~ PPE to prevent falling is not applied (e.g. due to a lack of time).

- Attachment points are possible where the maintenance point/monitoring point is located at least 2 m away from the fall edge together with a low utilization frequency.
Provide and mark attachment points on auxiliary steel structures under consideration of the fall heights as specified by structural engineers. Procure personal safety equipment, have regular inspections carried out, provide instruction. Design according to EN 795.
This protection alternative is consistently regarded as an ~~unsuitable~~ lower-priority measure !

- Will-dependent safety engineering

Implementation examples:

Q1 To view the photos in line 3 and column Q the corresponding photo shall be clicked to mark it. At one corner, drag the photo to the desired size. After viewing it, click "Undo editing" or the "Undo" arrow button.

Requirements:

In the case of a high risk potential, access shall be implemented via an extending ladder that has locking mechanisms on both sides and is secured with a contactless ~~Euchner~~ safety shutoff if the manufacturer's/supplier's ~~risk analysis~~ risk assessment permits this!

Q13

Back cage is only necessary as of a falling height of > 5m. Starting from 2.2 m to max. 3 m above ground. ~~In the outlined case, no safety cage would have been required!~~ Basis: DIN EN ISO 14122-4

Insofar as protruding platforms with attachable ladders are required, the following applies:

- A self-locking barrier/swing door to prevent falling, labeled with the ban "No unauthorized access" shall be planned.B94

- Perforated sheet paneling is rejected => too forceful from a visual perspective!C104
Standard protective grilles shall be used.

- Perforated sheet paneling is rejected => too forceful from a visual perspective.

K22 Self-closing doors shall generally be planned for access to new materials handling technology systems, irrespective of the risk. The working and traffic area shall be separated from the materials handling technology maintenance area.

L22 **Design according to OHS Guideline "Materials Handling Technology" (see requirement specifications):**
Doors with materials handling technology locking without electric safeguard and with a non-removable door striker shall generally be planned for new systems.
Access ban labeling, safety helmet requirement labeling, load specification for the level, labeling for 400 V system if necessary

M 22 The platform covering is usually a bottom guard mat.
Maintenance routes shall be marked, see OHS Guideline "Materials Handling Technology" in the requirement specifications

N22 Instead of railings, plan a 2 m high guard cover that cannot be climbed over, e.g. vertical bottom guard mat.

G23 Plan vertical ladder

L23	Safeguarding using removable safety fence as access option exclusively for maintenance and omission of electric safeguarding so that no access for operating personnel is created. Safeguarding of maintenance personnel using a personal padlock on the main/repair switch.
O23	The respective attachment point shall be usable on the guard cover prior to the start of dismantling.
E24	Mandatory, fixed access for system operators - not due to the inspection frequency but due to the user group of company operators = workers.
E26	Mandatory, fixed access - with no unauthorized access sign - for crane maintenance personnel if a catwalk is available.
L26	Door with locking mechanism for crane maintenance (without electric safeguard), panic closing, door striker, and no unauthorized access sign
O26	Attachment points for PPE to prevent falling shall be planned if there is a risk

Terms:

B7	**Maintenance (machine operator)** As per DIN 31051 (status 2012), maintenance is regarded as measures for delaying the degradation of the existing wear potential of the item under examination.
B8	**Fault elimination and monitoring** ~~Routine maintenance.~~ Physical measure carried out to restore the function of a defective unit
B10	**Repair** Restoration/reconstruction = process in which the required functional capability of a unit is restored after a failure.

Rem.: The decision matrix is also stored as an Excel file ~~on the SPPA requirement specifications CD~~ in DocMaster.

Decision Matrix: "Accessible Machines, Lifting Platforms and Platforms"

	Legende:
X	Häufigkeitsausprägung
■	empfohlene Ausführung
	... *von PT/SUM und Instandhaltungen der Center*
o	mögliche Variante
□	nur genehmigte Ausnahmefälle

Key:

X	Frequency characteristic
■	Design recommended
	... by PT/SUM and Maintenance of the centers
O	Possible variant
☐	Approved, exceptional cases only

Stand: 02.02.2018 **Version:** 2.0

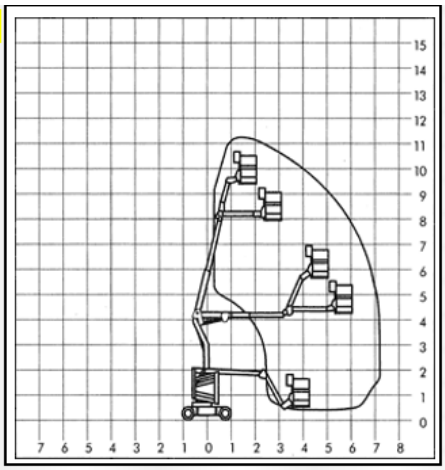
List of Figures:

Decision Matrix: "Accessible Machines, Lifting Platforms and Platforms"

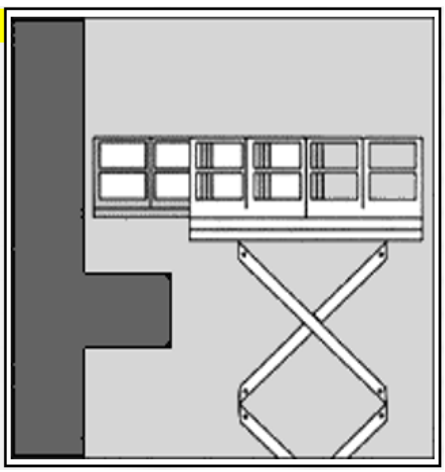
Zelle F3

Zelle G3

Zelle I3



Zelle J3

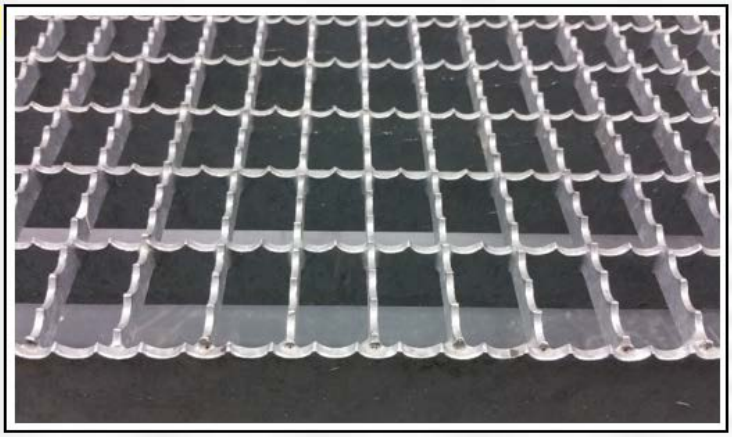


Decision Matrix: "Accessible Machines, Lifting Platforms and Platforms"

Zelle L3

Zelle K3

Zelle M3



Zelle N3

Zelle O3

Decision Matrix: "Accessible Machines, Lifting Platforms and Platforms"

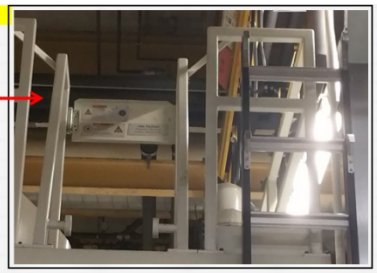
Zelle Q7

Zelle Q8

Zelle Q8

Zelle Q9

Zelle Q9



Zelle Q9

Decision Matrix: "Accessible Machines, Lifting Platforms and Platforms"

Zelle Q10

Zelle Q13

Zelle Q13

Decision Matrix: "Accessible Machines, Lifting Platforms and Platforms"

Zelle Q13

Zelle Q22

Decision Matrix: "Accessible Machines, Lifting Platforms and Platforms"

Zelle Q22

Zelle Q23

Decision Matrix: "Accessible Machines, Lifting Platforms and Platforms"

Zelle Q25

Zelle Q25

Decision Matrix: "Accessible Machines, Lifting Platforms and Platforms"

Zelle Q25

Zelle Q26

Decision Matrix: "Accessible Machines, Lifting Platforms and Platforms"

Zelle Q26

Zelle Q27

Decision Matrix: "Accessible Machines, Lifting Platforms and Platforms"

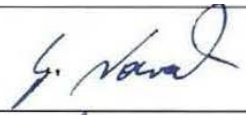
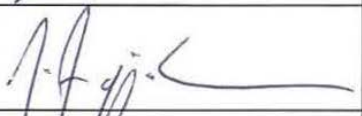
Zelle Q27

Zelle Q27

CC/TSWEM Pump Approval List

Modification and Approval

Design and Procurement Guideline for Pumps

1	H. Nowak CC/TSWEM Tel. 0711/17-32622 guenter.nowak@daimler.com		Nowak
2	H. Jungjohann CC/TSWEM Tel. 0711/17-26413 jan.jungjohann@daimler.com		Jungjohann
3	Fr. Zügner CC/TSWEM Tel. 0711/17-24472 georg.seidl@daimler.com		Zügner
Aend.	Ersteller: (Datum /Abt. /Unterschrift)		Freigabe: (Datum /Abt. /Unterschrift

1. Scope

Within Daimler AG, these guidelines apply to plants 10, 15, 19, 96 and 00, but not to plants 40-Berlin and 68-Hamburg. It applies both to new equipment and to the replacement of existing equipment. This concerns production, media supply and waste extraction installations as well as building supply systems.
The use of pumps in accordance with the current Powertrain Requirement Specifications, Part II (Mechanical Components), "Approval List for Mechanical and Fluid Components" (FGM) is binding in new projects.
If no restrictions are imposed there as to type and use, pumps from the CC/TSWEM pump approval list shall be used at Plants 10, 15, 19, 96 and 00. For Plants 40 and 68, special agreement must be reached.

2. Purpose

2.1 The restriction on companies and type series is intended to reduce the replacement parts and warehousing requirements.
2.2 Additionally, operating experience is to be incorporated when ordering new units.

3. Tender Procedure

If manufacturers and/or types not included in the WEM pump approval list are used, then an application for special approval is to be made to Daimler AG using the respective form, stating the reasons.

4. Warranty

Both for the pumps and their associated parts, such as the motor, baseplate, coupling guard etc. an anti-corrosion warranty for at least five years against rust penetration is required.

5. Documentation

As a minimum, the following documents are required:

- Fully completed data sheet for the pump(s) used from the pump manufacturer
- Chart of characteristic curves with operating point marked
- Operating instructions with erection plan and seal plan (for slide ring seals)
- Maintenance instructions, containing information on:
  a) Permissible lubricants
  b) Lubricating frequencies and
  c) Lubricant changes
- Material and test certificate (if specially requested)

6. Execution and Scope of Delivery

If not otherwise specified on the data sheet or in the order, the pumps shall be designed as follows:

6.1 Centrifugal Pump, Standard and Block Pumps
Procurement and implementation also as per VDMA 24296 and 24297

- with IEC standard motors, pluggable, up to 7.5 kW as per current "SPPA material data manager" (MDM), at least IE3 version
- With standard slide seal ring (LATTY, BURGMANN)
- Slide ring seals with integrated shaft sleeve (Cartex type)
- Pump shafts with or without additional shaft protection sleeve (for standard and close-coupled pumps)!
- With split rings on suction side
- Heavy-duty, hard-wearing coupling guard as per German accident prevention regulations UVV ZN 3230
- Coupling: Elastic design (Flender, Eupex type)
- Model plate: according to DIN 24299, Parts 1 and 2
  Specifications: Volume (m3/h), delivery height (m), power (kW), pump manufacturer, serial number

6.2 Positive-Displacement Pumps as per VDMA 24286

- With IEC standard motors, pluggable, up to 7.5 kW as per current "SPPA electrical system material approval list" (MDM), at least IE3 version.
- Heavy-duty, hard-wearing coupling guard as per German accident prevention regulations UVV ZN 3230
- Coupling: Elastic design (Flender, Eupex type)
- Model plate: according to DIN 24299, Parts 1 and 2
  Specifications: Volume (m3/h), delivery height (m), power (kW), pump manufacturer, serial number

6.3 Immersion Pumps:

- With motor, pluggable, up to 7.5 kW as per current material data manager (MDM), at least IE3 version

6.4 Special Features

- Rotational speeds: The use of slow-running pumps with 1,450 rpm is preferred.
  For frequent partial-load operation (fluctuating pressures and/or delivery rates), drives with frequency inverter as per current "SPPA Material Approval List for Electrical Components" (MFL-E) must be used.
  A near-system design or switchgear cabinet solution will be accepted.
- Frequency inverters from KSB and Grundfos can be used following consultation with the representative.

If installed in sewer systems, the safety regulations "Explosion protection in wastewater installations" must be observed.

Appendices:

- Pump list
- Pump special approval form

Nr.	Fabrikat	Baureihe	Baugröße	Bauart	Werkstoff	KW.	U/Min	Öl	Waschlauge	Emulsion	Heiz-u.Betr.W.T<130	Brauch.Wass.T<60	VE-Wasser	PH. 0-3	PH. 3-7	PH. 7-14	Abras.Fluss	Aggr.Fluss	Elektrolyte	Öl,Schlammh. Flüss.	Fäkalien	Kraftstoffe	Lack	Lösungsmittel	Harz
1	ABEL	F	Alle	Kolben-Membranpumpe	GG												X			X					
					VA							X							X						
2	ALLWEILER	AE	25-15500	Exzenterschneckenpumpe	GG			X		X							X			X					
					VA																				
		AED	25-15500	Exzenterschneckenpumpe	VA																				
					GG																				
		EMTEC-A (MDM)	20R46DQ W110221	Schraubenspindelpumpe	GG		3000	X		X															
		EMTEC-A (MDM)	40R46DQ W110221	Schraubenspindelpumpe	GG		3000	X		X															
		EMTEC-A-(MDM)	80R46DQ W110221	Schraubenspindelpumpe			3000	X		X															
		EMTEC-A (MDM)	140R46DQW110221	Schraubenspindelpumpe			3000	X		X															
		EMTEC-A (MDM)	210R46DQW110221	Schraubenspindelpumpe			3000	X		X															
		EMTEC-A (MDM)	280R46DQW110221	Schraubenspindelpumpe			3000	X		X															
3	BRINKMANN	TB (MDM)	16-100	Kreiselpumpe	GG	0,07-1,1	2900	X	X	X							X								
		TA (MDM)	160-600	Kreiselpumpe	GG	0,85-10	2900	X	X	X							X								
		SAL FGM 12.3	Alle Baugrößen	Kreiselpumpe	GG	0,8-10	2900	X		X															
		TH (MDM)	180-360;2-6	Kreiselpumpe	GG ; CrNi	0,5-10	2900	X	X	X							X								
		FH (MDM)	180-360;2-6	Kreiselpumpe	GG	0,5-10	2900	X	X	X							X								
		TC (MDM)	Alle Baugrößen	Kreiselpumpe	GG ; PBTP	0,38-2,6	2900	X		X							X								
		KC	21-60	Kreiselpumpe	B ; MS	0,37-1,1	2900	X		X															
		SB	20-60	Kreiselpumpe	GG ; MS	0,17-	2900	X		X															
		SBA	Alle Baugrößen	Kreiselpumpe	GG ; MS	0,17-1,5	2900	X	X	X															
		SBC (MDM)	Alle Baugrößen	Kreiselpumpe	GG	1,0-10	2900	X		X															
		TFS+FFS	Alle Baugrößen	Schraubenspindelpumpe	GG	0,75-45	2900	X		X															
		SFC	Alle Baugrößen	Kreiselpumpe	GG	4,0-10,0	2900	X	X	X							X								
		SFL (MDM)	Alle Baugrößen	Kreiselpumpe	CM3			X	X	X							X								
		SGL (MDM)	Alle Baugrößen	Kreiselpumpe	GG			X	X	X							X								
		KTF	Alle Baugrößen	Kreiselpumpe	PPS/POM							X	X												
4	CRANE	DL (MDM)	Alle Größen	Druckluft-Membranpumpe	GG			X	X	X										X					
					VA								X	X	X		X	X							
5	DICKOW	WPV	2521	Kreiselpumpe	GG							X										X			

Nr.	Fabrikat	Baureihe	Baugröße	Bauart	Werkstoff	KW.	U/Min	Öl	Waschlauge	Emulsion	Heiz-u.Betr.W.T<130	Brauch.Wass.T<60	VE-Wasser	PH. 0-3	PH. 3-7	PH. 7-14	Abras.Flüss	Aggr.Flüss	Elektrolyte	Öl.Schlammh. Flüss.	Fäkalien	Kraftstoffe	Lack	Lösungsmittel	Harz
		WPV	3521	Kreiselpumpe	GG							X										X			
		WPV	4521	Kreiselpumpe	GG							X										X			
6	EGGER	T		Kreiselpumpe			beliebig		X	X	X	X			X	X	X	X	X	X	X		X	X	
		EO		Kreiselpumpe			beliebig		X	X	X	X			X	X	X	X	X	X			X	X	
		EOS		Kreiselpumpe			beliebig		X	X	X	X			X	X	X	X	X	X			X		
7	EDUR	NUBF	300; 700	Kreiselpumpe	GG; GBZ							X	X												
8	FLYGT	B	2041 - 2540	Kreiselpumpe	GG/Alu		2900		X							X	X								
		C/N	3085- 3152	Kreiselpumpe	GG		1450-2900	X	X	X						X				X	X				
		D	2041	Kreiselpumpe	GG		1450	X	X	X						X				X	X				
			3152		VA		1450-2900	X	X	X			X	X	X	X		X		X	X				
		H	3127-3201	Kreiselpumpe	GG		1450	X	X	X						X	X			X					
9	GRACO	Bulldog (MDM)	215	Druckluft	ST																	X			
			594	Kolbenpumpe	VA																		X	X	
10	GRUNDFOS	MAGNA (-D)	1"bis DN 80	Kreiselpumpe	GG 20+25	max 1,1					X	X													
		UPS/UPSD	1"bis DN 100	Kreiselpumpe	Bronze						X	X													
		TPE/TPDE	1"bis DN 400	Kreiselpumpe	GG/GGG	bis 22		X	X	X	X	X				X									
					Bronze			X	X	X	X	X				X									
		TP/TPD (MDM)	1"bis DN 400	Kreiselpumpe	GG/GGG	bis 45	2/4/6	X	X	X	X	X				X									
					Bronze		polig	X	X	X	X	X				X									
		CR/CRN (MDM)	1 bis 90 m^3/h	Kreiselpumpe	GG,4401	45	2/4	X	X	X	X	X	X		X	X	X	X	X	X		X	X	X	
		CRI/CRT	2 bis 20 m^3/h		4301/Titan	15	polig	X	X	X	X	X	X		X	X	X	X	X	X		X	X	X	
		CRE/CRNE	3 bis 90 m^3/h	Kreiselpumpe	GG,4401	bis 22	bis	X	X	X	X	X	X		X	X	X	X	X	X		X	X	X	
		CRIE/CRTE	4 bis 20 m^3/h		4301/Titan		4500	X	X	X-	X	X	X		X	X	X	X	X	X		X	X	X	
		SPK	Alle Größen	Kreiselpumpe	GG/4301	bis 30	2	X	X	X					X	X	X	X	X	X		X			
		MTH/MTA/MTR					polig								X	X	X	X							
		SPKE/MTRE	Alle Größen	Kreiselpumpe	GG/4301	bis 22	bis 4350	X	X	X						X	X	X							
		SQ,SQE	Alle Größen	Kreiselpumpe	VA	bis 1,7								X	X										
		SP	Alle Größen	Kreiselpumpe	VA	250								X	X		X								
		SP-G				250								X	X										
		JP	Alle Größen	Kreiselpumpe	VA									X	X										
		Pomona	Alle Größen	Kreiselpumpe	GG		2polig	X	X	X	X				X	X	X				X				
		KP,AP,S, SV	Alle Größen	Kreiselpumpe	VA/GG	bis 4,5			X						X	X	X					X			
		Druckerhöhung	Alle Größen	Anlage	GG/Titan/VA								X	X	X										
12	HILGE	CN	1,2,3 ; 20BLDF	Kreiselpumpe	VA		1450-2900					X	X	X	X			X	X						
14	JOHNSON	FRES (MDM)	Alle Baugrößen	Kreiselpumpe	GG		2900	X	X	X							X								
15	KNOLL	TS (MDM)	40 bis 21	Kreiselpumpe	GG/Stahl		2900	X	X	X															
		TF (MDM)	40 bis 50	Kreiselpumpe	GG/POM		2900	X	X	X															

Nr.	Fabrikat	Baureihe	Baugröße	Bauart	Werkstoff	KW.	U/Min	Öl	Waschlauge	Emulsion	Heiz-u.Betr.W.T<130	Brauch.Wass.T<60	VE-Wasser	PH. 0-3	PH. 3-7	PH. 7-14	Abras.Flüss	Aggr.Fluss	Elektrolyte	Öl.Schlammh. Flüss.	Fakalien	Kraftstoffe	Lack	Lösungsmittel	Harz
		TG (MDM)	25 bis 50	Kreiselpumpe	GG		2900		X	X															
		KTS... (MDM)	Alle Baugrößen	Schraubenspindelpumpe				X		X															
		KTSV 20-30 (MDM)	25 bis 50	Dosier-Pumpe f. Silikon																					
16	KRACHT	KF-ZM ; KF-ZN	Alle Baugrößen	Zahnradpumpe	GG		1450	X	X	X															
		KF...(MDM)	Alle Baugrößen	Zahnradpumpe	GG		1450	X	X	X															
17	KSB	Etanorm / ETN (MDM)	Alle Baugrößen	Kreiselpumpe	GG / EN-GJL-250 *		1450-2900		X	X	X					X									
		Etanorm R (MDM)	Alle Baugrößen	Kreiselpumpe	GG / EN-GJL-250 *		1450-2900		X	X	X					X									
		Etanorm SYT / ETNY (MDM)	Alle Baugrößen	Kreiselpumpe	GGG / EN-GJS-400-18 LT *		1450-2900																		
		Etanorm V / ETNV (MDM)	Alle Baugrößen	Kreiselpumpe	GG / EN-GJL-250 *		1450-2900		X	X	X					X									
		Etabloc / ETB (MDM)	Alle Baugrößen	Kreiselpumpe	GG / EN-GJL-250 *		1450-2900	X	X	X	X	X	X		X	X									
		Etabloc SYT / ETBY (MDM)	Alle Baugrößen	Kreiselpumpe	GGG / EN-GJS-400-18 LT *		1450-2900																		
		Etachrom B / ETCB (MDM)	Alle Baugrößen	Kreiselpumpe	VA / 1.4571		1450-2900	X	X	X			X		X			X	X						
		Etachrom NC / Etachrom L / ETCL (MDM)	Alle Baugrößen	Kreiselpumpe	VA / 1.4571		1450-2900	X	X	X			X		X			X	X						
		Etaprime B (MDM)	Alle Baugrößen	Kreiselpumpe	GG / EN-GJL-250 *		1450-2900	X	X	X						X									
		Etaprime L	Alle Baugrößen	Kreiselpumpe	GG / EN-GJL-250 *		1450-2900	X	X	X						X									
		Etaline / Etaline R / ETL	Alle Baugrößen	Kreiselpumpe	GG / EN-GJL-250 *		1450-2900				X	X													
		Etaline SYT / ETLY	Alle Baugrößen	Kreiselpumpe	GGG / EN-GJS-400-18 LT *		1450-2900																		
		KWP	Alle Baugrößen	Kanalrad Kreiselpumpe	GG / EN-GJL-250 *		1450-2900	X	X	X							X			X					
		KWP Bloc	Alle Baugrößen	Kanalrad Kreiselpumpe	GG / EN-GJL-250 *		1450-2900	X	X	X							X			X					
		Multitec / MTC (MDM)	Alle Baugrößen	Kreiselpumpe	GG / EN-GJL-250 *		1450-2900	X	X	X		X							X						
		Movitec (MDM)	Alle Baugrößen	Kreiselpumpe	V2A / 1.4301 -		1450-2900		X	X	X	X	X	X	X	X								X	
					V4A / 1.4404 -				X	X	X	X	X	X	X	X								X	
		Sewatec	Alle Baugrößen	Kreiselpumpe	GG / EN-GJL-250 *		1450-2900	X	X	X						X	X			X					
					1.4517										X										
		Sewabloc	Alle Baugrößen	Kreiselpumpe	GG / EN-GJL-250 *		1450-2900	X	X	X						X	X			X					
					1.4517										X										
		HPK L	Alle Baugrößen	Kreiselpumpe	GGG 40.3 / EN-GJS-400-18 LT *		1450				X	X													
		Mega CPK / MCPK	Alle Baugrößen	Kreiselpumpe	VA / 1.4408		1450																		
		MK	Alle Baugrößen	Kreiselpumpe	GG / EN-GJL-250 *		1450-2900	X	X	X						X	X			X					
					1.4408										X										
		Amarex KRT	Alle Baugrößen	Tauchpumpe	GG / EN-GJL-250 *		1450	X	X	X		X					X			X	X				
					1.4517																				

Nr.	Fabrikat	Baureihe	Baugröße	Bauart	Werkstoff	KW	U/Min	Öl	Waschlauge	Emulsion	Heiz-u. Betr.W.T<130	Brauch.Wass.T<60	VE-Wasser	PH. 0-3	PH. 3-7	PH. 7-14	Abras.Flüss	Aggr.Flüss	Elektrolyte	Öl Schlammh. Flüss	Fäkalien	Kraftstoffe	Lack	Lösungsmittel	Harz
		Amarex N	Alle Baugrößen	Tauchpumpe	GG / EN-GJL-250 *		1450	X	X	X		X					X			X	X				
		Ama-Drainer	Alle Baugrößen	Tauchpumpe	Kunststoff / VA / GG / EN-GJL-250 *		2900	X	X	X		X			X	X		X		X					
		Ama-Porter	Alle Baugrößen	Tauchpumpe	GG / EN-GJL-250 *		1450-2900	X	X	X		X					X			X	X				
		Compacta	Alle Baugrößen	Hebeanlage	Kunststoff / GG / EN-GJL-250 *		1450-2900														X				
					Kunststoff / GG / EN-GJL-250 * beschichtet		1450-2900											X			X				
		Mini-Compacta	Alle Baugrößen	Hebeanlage	Kunststoff / GG / EN-GJL-250 *		2900														X				
		Ama-Drainer Box	Alle Baugrößen	Hebeanlage	Kunststoff / VA /		2900	X	X	X		X			X	X		X		X					
		Calio	Alle Baugrößen	Kreiselpumpe	GG / EN-GJL-250 *		1450-2900				X	X													
18	NETZSCH	NM/SY	Alle Baugrößen	Exzenterschnecken-pumpe	GG			X												X					
					VA													X	X						
19	RITZ	Bloc (MDM)	Alle Baugrößen	Kreiselpumpe	GG		1450-2900	X	X	X	X	X													
		Norma (MDM)	Alle Baugrößen	Kreiselpumpe	GG		1450	X	X	X	X	X													
		45 (MDM)	Alle Baugrößen	Kreiselpumpe	GG		1450	X	X	X		X													
		AS (MDM)	Alle Baugrößen		GG		2900																		
		49	Alle Baugrößen	Kreiselpumpe			1450			X		X													
		38 A, B, E	Alle Baugrößen	Kreiselpumpe	GG/		1450		X	X	X						X			X					
20	DESMI	HD,CD	26-201	Zahnradpumpe	GG; VA		1450	X															X		
21	SCHMALENBERGER	ZHS (MDM)	Alle Baugrößen	Kreiselpumpe	GG,VA; PMO;PPS		2900	X	X	X		X	X					X	X						
		ZHB (MDM)	Alle Baugrößen	Kreiselpumpe	GG,VA		2900	X	X	X		X	X					X	X						
		ZHT (MDM)	Alle Baugrößen	Kreiselpumpe	GG,VA		2900	X	X	X		X	X					X	X						
		THK (MDM)	Alle Baugrößen	Kreiselpumpe	GG,VA,			X	X	X		X	X					X	X						
		SM (MDM)	Alle Baugrößen	Kreiselpumpe	GG 20				X	X		X													
		S (MDM)	Alle Baugrößen	Kreiselpumpe	GG	2900			X															X	
		Z (MDM)	Alle Baugrößen	Kreiselpumpe	GG	2900	X	X	X										X						
		FB (MDM)	Alle Baugrößen	Kreiselpumpe	GG	1450	X	X	X								X				X	X			
22	SIHI	AKH	1101-6103	Kreiselpumpe	GG		1450			X												X			
		ADH	1103-3603	Kreiselpumpe	GG		1450			X			X									X			
23	SONDERMANN	RM (MDM)	Alle Baugrößen	Kreiselpumpe	PVDF, PP									X	X	X									
		RMS (MDM)	Alle Baugrößen	Kreiselpumpe selbstsaug.	PVDF									X	X	X									
24	Verder	Hydracell (MDM)	G10,G20,G25,G30	Kolben-Membranpumpe	GG	7,5	>1500	X	X	X	X	X				X	X			X		X	X	X	X
		Verder V Flex	Alle Baugrößen	Schlauchpumpe			> 150	X	X	X		X	X	X	X	X	X	X	X	X		X	X		X
		Verder Air	1/8" bis 3"	Druckluftmembranpumpe	GG			X	X	X		X								X		X	X	X	X

Nr.	Fabrikat	Baureihe	Baugröße	Bauart	Werkstoff	KW.	U/Min	Öl	Waschlauge	Emulsion	Heiz-u.Betr.W.T<130	Brauch.Wass.T<60	VE-Wasser	PH. 0-3	PH. 3-7	PH. 7-14	Abras.Flüss	Aggr.Flüss	Elektrolyte	Öl.Schlammh. Flüss	Fäkalien	Kraftstoffe	Lack	Lösungsmittel	Harz
25	**WILO+EMU**																								
		IL	Alle Baugrößen	Kreiselpumpe							X														
		Stratos	Alle Baugrößen	Kreiselpumpe							X														
		Z	15/WS ; 25/WS	Kreiselpumpe	Bronse							X													
		FA 05-32 RF	125-144	Kreiselpumpe	VA		1450-2900						X					X	X						
		FA 05.33	100 ; 125	Kreiselpumpe	GG		2900		X	X											X				
		MVI	Alle Baugrößen	Kreiselpumpe	GG ; VA		1450									X									
El. Faß- und Behälterpumpen																									
26	**GRÜN**	p310	D= 40 mm	Fasspumpe	Kunsttoff	0,52	8500		X			X	X	X	X	X		X	X						
			Längen (mm)	Fasspumpe	Edelstahl	0,52	8500		X			X	X		X	X									
			700	Fasspumpe	Aluminium	0,52	8500		X			X													
		p400	1000	Fasspumpe	Kunsttoff	0,85	8500		X	X		X	X	X	X	X		X	X						
			1200	Fasspumpe	Edelstahl	0,85	8500	X	X	X	X	X	X		X	X							X		
			andere auf	Fasspumpe	Aluminium	0,85	8500	X	X	X		X												Wasserbasis	
		Ex700	Anfrage	Fasspumpe	Edelstahl	0,7	8500	X	X	X	X	X	X		X	X				X		X	X	X	
		d600		Fasspumpe	Kunsttoff	0,6	8000		X	X		X	X		X	X		X	X						
				Fasspumpe	Edelstahl	0,6	8000	X	X	X	X	X	X		X	X				X			X	X	
				Fasspumpe	Aluminium	0,6	8000	X	X	X	X	X												Wasserbasis	
Dosierpumpen																									
27	**Sera (Seybert+Rahier)**	Sera	C203-2, 4e	Dosierpumpe	1.4571 / 1.4401			X	X	X			X	X	X	X								X	
		Sera (MDM)	R203-2, 4e	Dosierpumpe	PP-GFK; Glas; FPM			X	X	X			X	X	X	X								X	
		Sera (MDM)	R203-14e	Dosierpumpe	PP-GFK; Glas; FPM			X	X	X			X	X	X	X								X	
		Sera	C203-25e	Dosierpumpe	PP-GFK; Glas; FPM			X	X	X			X	X	X	X								X	
		Sera	C203-6, 0e	Dosierpumpe	PP-GFK; Glas; FPM			X	X	X			X	X	X	X								X	
		Sera R409.2	Alle Baugrößen	Dosierpumpe	PP-GFK; Glas; FPM			X	X	X			X	X	X	X								X	
		Sera R410	Alle Baugrößen	Dosierpumpe	PP-GFK; Glas; FPM			X	X	X			X	X	X	X								X	
28	**Grundfos FGM 13.1**	DME,DMS,DDI,DMI,DMX,DMH	Alle Baugrößen	Dosierpumpe	nach Anforderung			X	X	X			X	X	X	X								X	
Vakuumpumpen																									
29	**LEYBOLD**	Sogevac (MDM)	Alle Baugrößen	Drehschieberpumpe	ALU		1450	Absaugung von Gasen																	
		DK (MDM)	Alle Baugrößen	Sperrschieber				Absaugung von Gasen																	
30	**GARDNER&DENVER**	VACFOX VC (MDM)	VC203/303	Drehschieberpumpe	ALU		1450	Absaugung von Gasen																	

Nr.	Fabrikat	Baureihe	Baugröße	Bauart	Werkstoff	KW.	U/Min	Öl	Waschlauge	Emulsion	Heiz-u.Betr.W.T<130	Brauch.Wass.T<60	VE-Wasser	PH. 0-3	PH. 3-7	PH. 7-14	Abras.Flüss	Aggr.Flüss	Elektrolyte	Öl.Schlammh. Flüss.	Fäkalien	Kraftstoffe	Lack	Lösungsmittel	Harz
	(Rietschle)	Twister SVSI	120-800	Schraubenspindelpumpe		3,0-15,0	Absaugung von Gasen																		
		2BH1 (MDM)	Alle Baugrößen	Seitenkanalverdichter				Absaugung von Gasen																	
31	GEBR. BECKER	SV (MDM)	Alle Baugrößen	Seitenkanalverdichter				Absaugung von Gasen																	
		VT (MDM)	Alle Baugrößen	Drehschieberpumpe				Absaugung von Gasen																	
Hochdruckpumpen																									
32	Woma	Z-Baureihe (MDM)	Alle Baugrößen	Plungerpumpe				X	X	X															
		ARP-Baureihe (MDM)	Alle Baugrößen	Plungerpumpe				X	X	X															
33	HAMMELMANN	HDP (MDM)	HDP127 Rest nur mit Sonderfreigabe	Kolbenpumpe	VA			X	X	X															
34	WEPUKO	DP (MDM)	Alle Baugrößen	Kolbenpumpe	VA				X	X															

Key

Nr.	Fabrikat	Baureihe	Baugröße	Bauart	Werkstoff	KW	U/min	Öl	Waschlauge	Emulsion	Heiz-u.Betr.W T<130	Brauchwasser T<80	VE-Wasser	PH. 0-3	PH.3-7	PH. 7-14	Abras.Flüss.	Aggr.Flüss.	Elektrolyte	Öl.Schlammh. Flüss.	Fäkalien	Kraftstoffe	Lack	Lösungsmitel	Harz

No.	Manufacturer	Model series	Size	Design type	Material	KW	rpm	Oil	Cleaning detergent	Emulsion	Heat and contrib. W T<130	Service water T<80	DI water	PH. 0-3	PH.3-7	PH. 7-14	Abras. fluid	Aggr. fluid	Electrolyte	Oil sludge fluid	Black water	Fuel	Paint	Solvent	Resin

Kolben-Membranpumpe	Piston diaphragm pump
Exzenterschneckenpumpe	Eccentric spiral pump

Schraubenspindelpumpe	Helical spindle pump
Kreiselpumpe	Centrifugal pump
Alle Baugrößen	All sizes
Druckluft-Membranpumpe	Compressed air diaphragm pump
Alle Größen	All sizes
Druckluft	Compressed air
Anlage	System
25 bis 50	25 to 50
Dosier-Pumpe f. Silikon	Metering pump for silicone
Zahnradpumpe	Gear pump
Kanalrad Kreiselpumpe	Centrifugal pump with channel impeller
Tauchpumpe	Immersion pump
Hebeanlage	Hoist
Kreiselpumpe selbstsaug.	Self-extracting centrifugal pump
1/8“ bis 3“	1/8" to 3"
Fasspumpe	Barrel pump
Dosierpumpe	Metering pump
Drehschieberpumpe	Rotary vane pump
Sperrschieber	Locking valve
Seitenkanalverdichter	Side channel blower
Plungerpumpe	Plunger pump
Kolbenpumpe	Piston pump
Rest nur mit Sonderfreigabe	Remainder only with special approval
beliebig	Arbitrary
Bronze	Bronze
polig	poles
bis	to
Kunststoff	Plastic
VA	VA
GG	GG
Wasserbasis	Water base

Absaugung von Gasen	Extraction of gases
Glas	Glass
nach Anforderung	on demand

Non-slip Grating

This planning document is valid for building fixtures and also for machine platforms that are delivered by the machine manufacturer.

Grating with meshing or nubs on all rods
A grate with a slip resistance of R 12 is designed as described:
Nubs or meshing on supporting rod, transverse rod, and round rod. (Figure 3 and Figure 4)

A slip resistance of R 9 is generally considered very unsafe and therefore does not play a role in the commercial applications for grating.

A slip resistance of R 10 and R 11 is safe only in a dry workplace (sand/dry chips).

In "wet working areas"–if e.g. oil or other slippery substances are spread–a minimum slip resistance of R 12 must be aimed for so that the workplace can be walked on safely.

For particularly extreme conditions, a slip resistance of R 13 must be aimed for.

Laying the Grating

Walking direction
Grating must always be laid so that the supporting rod points in the walking direction and the transverse rod automatically points transversely to the walking direction.

The toothing or notching on all bars enables safe walking in all directions.

Attachment of the grating
Gratings shall be secured against being lifted out or moved inadvertently.

Gratings in Front of Switchgear Cabinets and on Platform Surfaces

If workplaces are located beneath grating platforms, a grate with the smallest grid dimension (see table) shall always be installed. This also applies to switchgear cabinets on grating platforms. This is to prevent any objects from falling through the grating during repairs and injuring someone.

Generally a grating with a supporting bar of at least 3 mm shall be placed on the platform. The grating should allow the transport of switchgear cabinets or production aids across the grating without bending the grating.

Summary

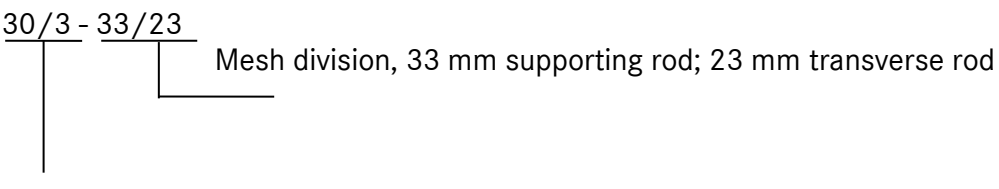
For this reason, gratings in compliance with slip resistance requirements, especially for damp areas, were developed in cooperation with various manufacturers. This was also achieved thanks to meshing or nubs on all rods. Constant inhibition of skidding is therefore guaranteed in all running directions.

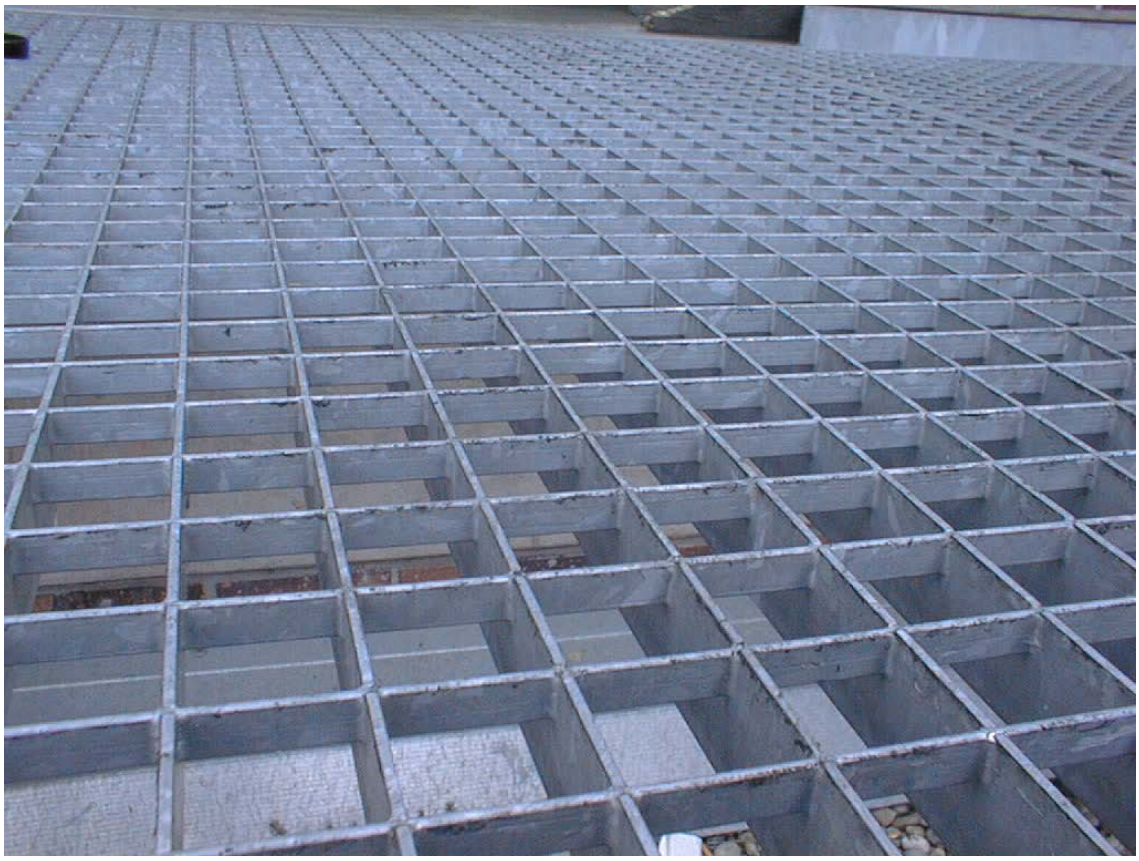
Definition of
For safety-related reasons, grating (pressed grating) should be used only as per the following table.

Requirement	Application examples	Possible application locations	30/3-33/33 **R 10**	30/3-42/12 **R 10**	30/3-33/33 **R12**	30/3-33/22 **R 12**
Dry areas						
	Platform	Footbridge or transition	X	X		
		Maintenance platform	X	X		
		Operator's platform and in front of control cabinet		X		
	Workplace	Assembly and manufacturing before machine		X		
	Basement equipment for supply technology	Platform and stairs				X
Wet areas						
	Platform	Operating platform			X	X
	Workplace	Manufacturing before machine			X	X
		Cavity preservation			X	
		Before assembly workplace				X
Transitions and stairs						X

A slip resistance of R 12 should be reached through nubs or meshing on the supporting rod, transverse rod, and round rod.

Dimensions
The dimensions of gratings are generally specified as follows:

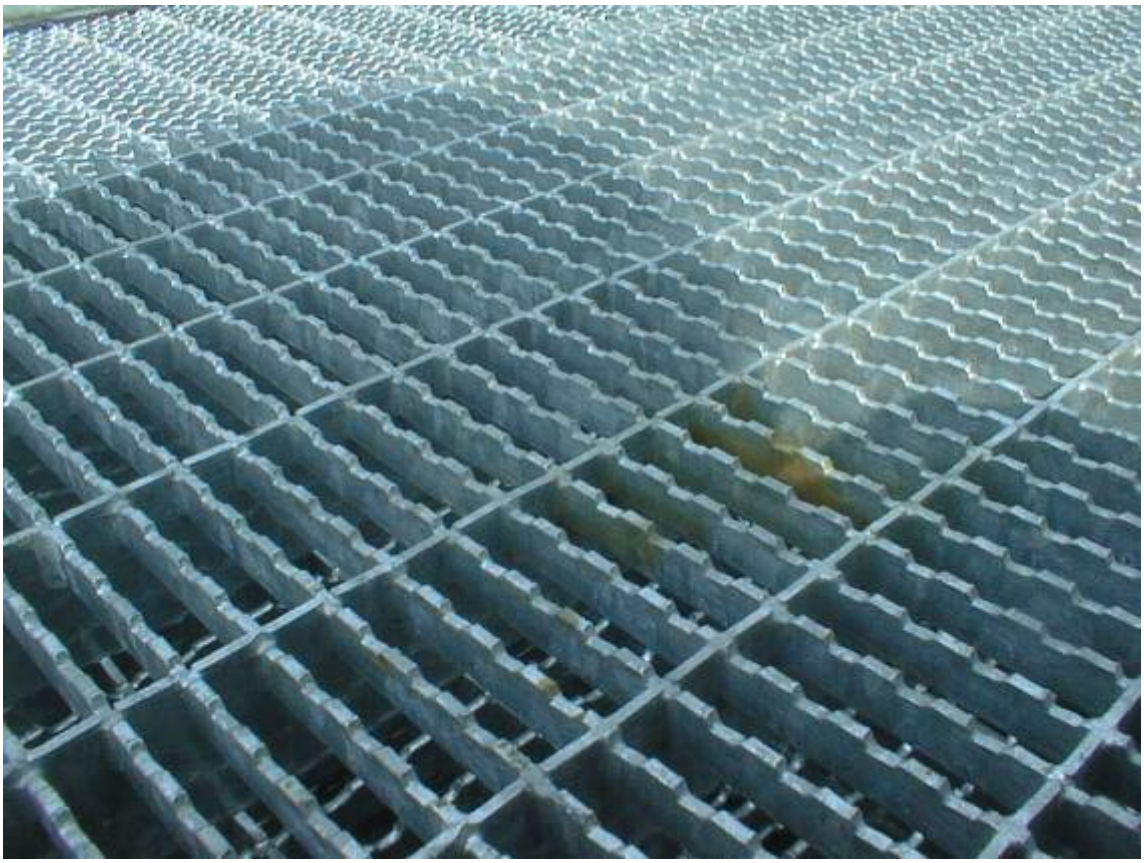




Standard Grating **Figure 1**

- Dimensions: 30/3–33/33
- Indicated slip resistance: R 10
- Actual slip resistance: R 10
- Special consideration: The transverse rod is compacted so that it is level with the supporting rod. A flat surface is created.
- **Use case:** Suitable only for dry areas, e.g. on footbridges, transitions, and maintenance platforms.

Standard Grating **Figure 2**

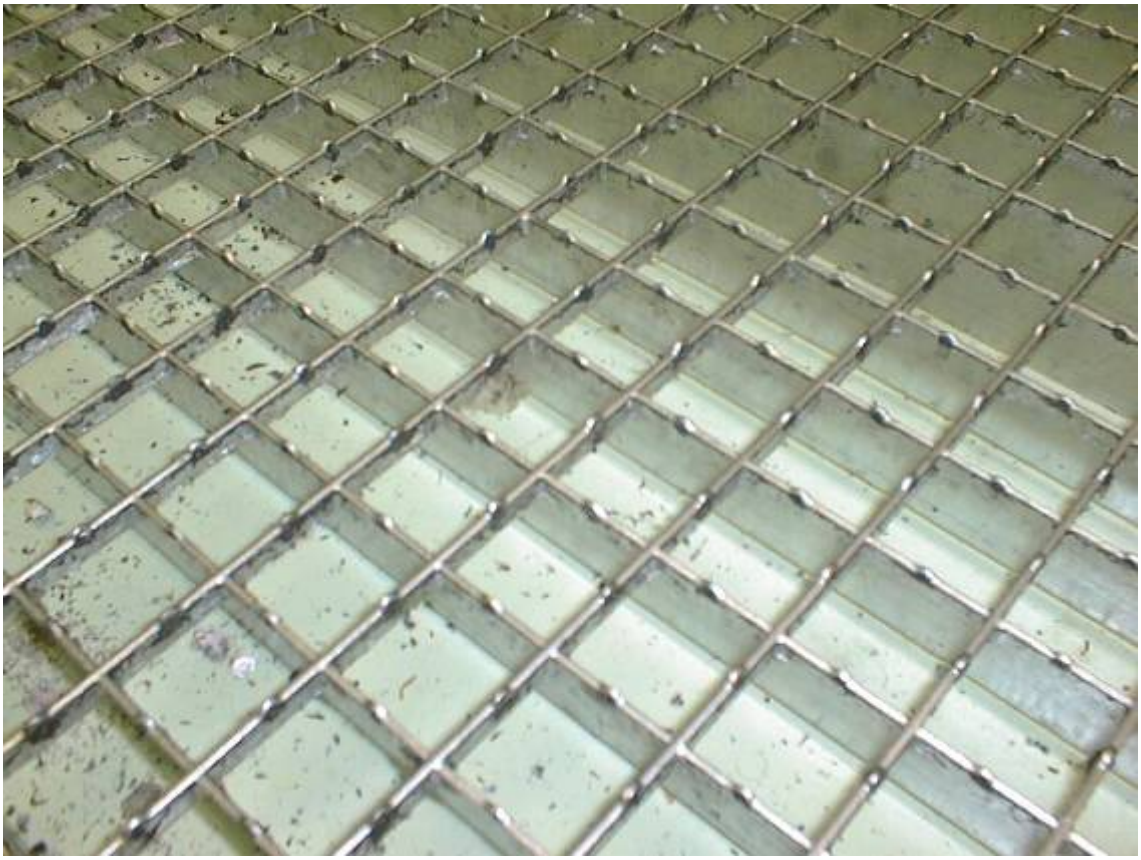


- Dimensions: 30/3–42/12
- Indicated slip resistance: R 10
- Actual slip resistance: R 10
- Special consideration: The transverse rod is compacted so that it is level with the supporting rod. A level surface occurs, which is interrupted by recess clearances in the transverse rod.
- **Use case:** Suitable only for dry areas

Grate with higher slip resistance **Figure 3**

Two examples of how grating with a slip resistance of R 12 might look.

Ex. 1



- Dimensions: 30/3–33/33
- Specified non-skid class: R12
- Effective non-skid class: R12
- Special consideration: Transverse rod, supporting rod, and round rod have nubs or saw toothing (nubs in this case). The notching results in skidding being inhibited in all directions.
- **Use case:** Suitable for use in wet areas.

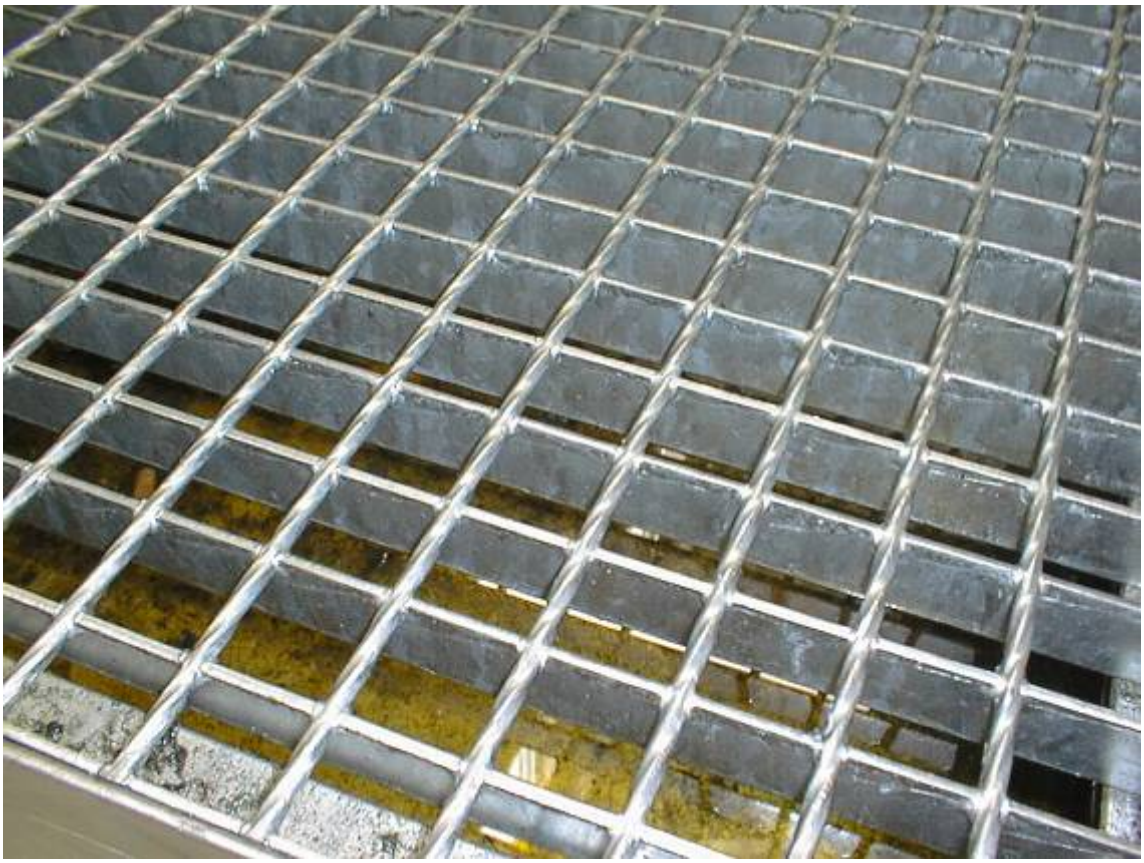
Grate with higher slip resistance **Figure 4**

Ex. 2

- Dimensions: 30/3–33/22
- Specified non-skid class: R12
- Effective non-skid class: R12
- Special consideration: Transverse rod, supporting rod, and round rod have saw toothing or nubs (saw toothing in this case). This leads to the inhibition of skidding in all directions.
- **Use case:** For wet areas

Forge-welded grating **Figure 5**

Do not use grating.



- Dimensions: 30/3–33/33
- Indicated slip resistance: R 12 (for new grating and in only one direction)
- Actual slip resistance: **R 10** (only in one direction)
- Special consideration: The drilled transverse rod is pressure-welded so that it is level with the supporting rod. A level surface that has no breaks is the result.
- Use case: None. Do not use grating due to unsafe slip resistance.

Sheet-metal profile grating **Figure 6**

Do not use grating.

- Dimensions: Grid dimension 30; height 40 mm
- Specified non-skid class: R12
- Special consideration: The indicated slip resistance is fully effective only in one direction (transverse to the installation direction).
- Use case: None. Do not use grating due to unsafe slip resistance.

Attachment of gratings Figure 7

Each grating must be diagonally secured at least twice (EPK - metalwork, Daimler).

In areas in which there is a risk of falling or falling in, the grating must at least be fastened at the four corner points (DGUV Information 208-007, previously BGI 588).

Inclined approach to oil pan Figure 8

The inclined approach, consisting of gratings, should be an alternative to the inclined approach consisting of grooved sheet metal which is already in use.

The inclined approach consisting of gratings can be both welded-on and bolted-on. It can therefore be removed for cleaning. On relocation of the machine, the inclined approach can also be reused.

Ascent ladder with wide steps Figure 9

The wide steps enable the entire front of the foot to be placed down when ascending and descending.

The notching on the step edge additionally increases safety.

Nosing edge for possible retrofitting of steps and ladders Figures 10- 13

Nosing edge

- Dimensions: 30/3
- Specified non-skid class: R12
- Special consideration: Some manufacturers design the nosing edges of the steps with a ridged design (Figures 10 and 13)

Use case: For all steps made out of grating.

For retrofitting existing staircases or ladders as a measure in connection with the hazard assessment (Figure 10).

- The standardized ladder steps and steps (especially on older models) are always rounded off on the front edges.

- Anti-skid safety is significantly increased if a notched step strip is installed on the front ladder steps and steps. This measure is (because of risk of injury) recommended only if the surroundings contain slippery substances (e.g. oil, grease, water, etc.).