



Contract document for systems and machines

Applies to the following companies:

Walter Klein GmbH & Co. KG
Wuppertal and Bad Laasphe

WKW Aktiengesellschaft

WKW Engineering GmbH

WKW Roof Rail GmbH

WKW North America LLC.

WKW AnodiCoat GmbH & Co. KG

All previous issues of our contract document become invalid with the publication of this directive!

Dear Contractor,

the present contract document serves as basis for construction, building and effective maintenance of systems and machines.

Great importance has been given to the following aspects:

- ⇒ highest possible level of occupational safety
- ⇒ high availability of machines and systems,
- ⇒ quick fault finding and troubleshooting,
- ⇒ cost-effective expandability of machines and systems,
- ⇒ cost-effective warehousing,

The statements in this contract document apply in principle to all systems and machines and must be complied with. Any claims, specifications and agreements beyond that are subject to project-related agreement and coordination between customer and contractor based on a check list.

Should it become clear during final inspection that the design of the system or machine equipment deviates from the requirements of this contract document and any additional agreements without our approval, we will insist on rectification at the expense of the contractor.

Unless otherwise indicated, your contacts in our company are:

a) Mechanical equipment and construction

Stefan Goldermann

Tel.: 0202/4039-6648 Fax: 0202/4039-5648 E-mail: stefan.goldermann@wkw.de

Norbert Miller

Tel.: 0202/4039-6671 Fax: 0202/4039-5671 E-mail: norbert.miller@wkw.de

b) Electrical equipment and programming

Michael Möhrke

Tel.: 0202/4039-6673 Fax: 0202/4039-5673 E-mail: michael.moehrke@wkw.de

Achim Kepper

Tel.: 0202/4039-6659 Fax: 0202/4039-5659 E-mail: achim.kepper@wkw.de

Looking forward to a good cooperation

Table of contents

TABLE OF CONTENTS	3
1 GENERAL INFORMATION.....	6
1.1 Energetic consideration of media.....	6
1.2 Inspections	6
1.3 System / machine documentation.....	7
1.3.1 Delivery dates of documentation.....	7
1.3.2 Machine data	7
1.4 Assemblies and components used	8
1.5 Plant data	8
1.5.1 Plant networks	8
1.5.2 Areas with dust exposure	8
1.6 Preliminary test / progress control	8
1.6.1 Final inspection / acceptance.....	8
1.7 Design data.....	9
1.8 Risk analysis	9
1.9 Training on operation	9
1.10 Surface requirements.....	9
1.11 Component identification	9
1.12 Warranty.....	9
1.13 Company logos	9
1.14 Machine Colors	9
2 ELECTRICAL EQUIPMENT.....	10
2.1 Design of installations	10
2.1.1 Protection, installation and designation of cables and lines	10
2.1.2 Suitability of cables and lines.....	11
2.1.3 Drag chains	11
2.1.4 Potential equalisation / protective conductor	11
2.1.5 Valve control.....	11
2.2 Design of switch cabinets, control panels and terminal boxes.....	11
2.2.1 Type plate.....	11
2.2.2 Setup of switch cabinets.....	11
2.2.3 Setup of panels and operator stations	12
2.2.4 Function texts on front and panel plates.....	12
2.2.5 PG-interface	12
2.2.6 Setup of terminal boxes.....	12
2.2.7 Colour scheme of wiring	12
2.2.8 Reserves	13
2.3 General requirements and information on electrical equipment.....	15

2.3.1	EMERGENCY STOP switch.....	15
2.3.2	Heat dissipation.....	15
2.3.3	Motor protection.....	15
2.3.4	Motor start.....	15
2.3.5	Surge protection.....	16
2.3.6	Shielding.....	16
2.3.7	Data transmission.....	16
2.3.8	Control with high switching rate.....	16
2.3.9	Control voltage.....	16
2.3.10	Mobile equipment.....	16
2.3.11	Working area lighting / workspace lighting.....	16
2.3.12	Laser products.....	16
2.4	Availability, fault finding, troubleshooting.....	16
2.4.1	Control concepts.....	17
2.4.2	Operating modes.....	18
2.4.3	Messages.....	19
2.4.4	Protection of peripheral components.....	19
2.4.5	Accessibility and protection of peripheral equipment.....	19
2.5	Documentation.....	20
2.5.1	Circuit diagram.....	20
2.5.2	Connection diagrams (terminal diagrams).....	20
2.5.3	Installation plans (cable diagram).....	20
2.5.4	Descriptions.....	20
2.5.5	Maintenance and maintenance intervals.....	20
2.5.6	Parts lists.....	21
2.5.7	Spare parts list.....	21
2.5.8	Software documents.....	21
2.5.9	Configuration, parameterisation.....	21
2.5.10	Test certificates.....	21
2.6	Device selection regulation.....	21
2.6.1	Power supply systems.....	22
2.6.2	Power switch.....	22
2.6.3	Command and indication units.....	22
2.6.4	Position switch.....	23
2.6.5	Power contactors, auxiliary contactors and relays.....	23
2.6.6	Devices for acquisition of non-electr. quantities.....	24
2.6.7	Automation devices.....	24
2.6.8	Machine operation, visualisation.....	24
2.6.9	Motors.....	24
2.6.10	Drive technology.....	24
2.6.11	Installation material.....	25
3	MECHANICAL PART.....	26
3.1	Design of installations.....	26
3.1.1	Installation, protection and designation of pipe and hose lines.....	26
3.1.2	Transportation.....	26
3.1.3	Setup and fastening.....	26
3.1.4	Setup of devices, tools and special machines.....	26
3.1.5	Cleaning.....	26
3.2	Documentation.....	27
3.2.1	Operating instructions.....	27
3.2.2	Drawings.....	27
3.2.3	Hydraulic plans.....	27
3.2.4	Pneumatic plans.....	27
3.2.5	Maintenance instructions.....	27

3.2.6	Lubrication charts.....	27
3.2.7	Parts lists	27
3.2.8	Spare parts lists	28
3.3	Device selection regulations.....	29
3.3.1	General mechanical components	29
3.3.2	Hydraulic components	29
3.3.3	Pneumatic components.....	29
4	APPENDIX	30
4.1	Templates in EXCEL file <Anhang.xls>	30
4.1.1	Contacts.....	30
4.1.2	Machine data sheet	30
4.1.3	Spare parts list-Electrical	30
4.1.4	Spare parts list-mechanical.....	30
4.1.5	Lubrication chart	30
4.1.6	Agreements on deviations	30
4.1.7	Energetic consideration of media	30
4.2	Template for inspection and acceptance certificates.....	30
4.3	Template for installation certificate	30
4.4	Template for type plate.....	30
4.5	Checklist for devices and tools for presses	31
5	INDEX.....	31
6	REVISION HISTORY.....	34

1 General information

The designs of the supplied systems and machines must be in compliance with relevant laws and regulations beyond any doubt. We refer specifically to the following directives and laws:

- ▶ Machine Directive
- ▶ Equipment Safety Act
- ▶ Industrial Safety Regulation
- ▶ Low-Voltage Directive
- ▶ EMC Directive
- ▶ EC - Framework Directive on Waste
- ▶ EC - Regulation

The contractor is responsible for the proper function of the system or machine and compliance with laws, directives, regulations and provisions in force at the time of contract conclusion, and compliance with the ISO50001, use of energy efficient products.

Compliance with the requirements in this contract document has no affect on the stipulations contained in above mentioned regulations and laws.

For systems which are intended for North America, the laws of the nec 2011 "National Electrical Code" (NFPA70) shall apply.

The nec 2011 refers to the UL508A (Industrial controll panel) and the NFPA 79 (Industrial Machinery). These standards are mandatory to be observed.

Machines for North America will be checked by an expert who is listed in the OSHA (Occupational Saftey and Health Administration).

1.1 Energetic consideration of media

For the following media an energetic assessment shall be performed by the contractor (Appendix 4.1.7). The result is submitted to the client with tender. The arrangement / assessment will be protocolled.

- *Current*
- *Water*
- *Gas*
- *Compressed air*
- *Coldness / warmth*

There warranted properties are to demonstrate after the commissioning by the supplier, and accordingly to log.

1.2 Inspections

Prior to initial commissioning, the supplied system or machine must be inspected by contractor / supplier for compliance with all corresponding accident prevention regulations, the specified safety devices and the accepted rules of engineering. If there is no respective agreement with the customer, all inspections concerning initial commissioning must be carried out by contractor. A written confirmation that the specified inspection has been performed is to be attached to the system documentation. The enclosed form (installation certificate) can be used to confirm the inspection according to **DGUV V3 (previously BGV A3)**.

All acceptance reports associated with the delivery, such as TÜV inspections (German Technical Inspection Agency), shop tests, initial commissioning tests etc. are part of the delivery and must be handed over to the customer latest at time of delivery. The CE mark must be affixed when the machine or system is delivered, but latest at time of commissioning, and the corresponding EC Declaration of Conformity must be handed to the customer. Without EC Declaration of Conformity, there will be no acceptance!

To protect his interests, the customer has the unconditional right to perform checks or inspections of any kind or appoint third parties, specifically during production phase at contractor's facility.

The contractor must specify in writing any acceptance and monitoring duties concerning systems or components or other equipment. The documents required for reporting to the respective monitoring organisation, for instance:

- ▶ Certificate of final inspection and pressure tests or certificate of compliance of qualification approval
- ▶ Certificate of materials used
- ▶ Drawings

must be provided automatically in form of a single copy prior to commissioning. In case of Ex-systems, all PTB test certificates must be produced. For the energetic decrease the ratio of kilowatt per hour is to be determined. These papers shall subsequently be added to the documentation.

1.3 System / machine documentation

Documentation must always be provided according to DIN or EN (UL-Standard for machines that goes to America), if possible in DIN A4 format in standard folders. In doing so, each folder shall only be filled up to max. 80%! The folders must be labelled according to their content. The folder label must also include the circuit diagram number or project number assigned by us.

Insofar as the documentation or parts thereof are created on PC systems, we are also requesting a copy of these data on CD-ROM.

The documentation is 2x on paper and 1x on CD-ROM.

For our plants in America, the system documentation must be prepared entirely in English. This includes operating manuals, circuit diagrams, parts lists and - when using PLC programs - also symbol tables, user interfaces, network comments, comments in robot programs, etc.

Otherwise, the documentation is to be prepared in German.

The documentation for system or machine shall consist of the following parts

1. **General part** with
 - ▶ table of contents of the documentation provided
 - ▶ system / machine data (see 1.3.2)
 - ▶ list of contacts with telephone numbers (see 4.1.1)
 - ▶ operating instructions
 - ▶ all required test reports and test certificates
 - ▶ if necessary, list with particulars to be considered during maintenance work
2. **Electrical documentation**
 - ▶ (see 2.5)
3. **Mechanical documentation**
 - ▶ (see 3.2)

1.3.1 Delivery dates of documentation

After order placement, the contractor must present the technical documentation in a timely manner for approval. The equipment of the machine or system is to be prepared only after the documentation with possible changes and the notice of approval (also by the plants) has been received.

In case of subsequent changes, the revised documents must be re-submitted for approval. The approval concerns only the principle of design; however, it does not relieve the contractor from the responsibility for proper and state-of-the-art construction, flawless function and dimensioning of the components.

Information on connection values and main fuses must be made available to the plant three weeks prior to the delivery of the machines.

1.3.2 Machine data

The contractor is to complete a system-machine data sheet (see 4.1.2) with the corresponding data for the supplied system / machine. After commissioning, the actually measured full load current, no load current and the ratio of KWh per hour must be entered in the „Electrical connection“ section.

1.4 Assemblies and components used

In principle, the assemblies and devices listed in this contract document under the items *Device selection* (2.6 & 3.3) shall be used. They may only be installed in their original state and without any modification. It is not permitted to use components that are no longer manufactured at time of order placement or for which a phase-out has already been announced.

All components must be delivered with the original type plate. During assembly, the setup and installation instructions of the device and system manufacturers must be followed. When selecting the appliances, prefer energy efficient devices.

1.5 Plant data

In principle, the contractor is responsible for obtaining information about the electrical, pneumatic, operating and network conditions at the installation location of the system or machine, with the support of the customer.

1.5.1 Plant networks

1.5.1.1 Electrical energy supply DS 380/400 Volt, 50 Hz (380 V at EA)

Our in-plant electrical network is a TN-C-S-network, featuring PEN for line cross-sections of $\geq 10 \text{ mm}^2$ and isolated neutral and protective conductor for line cross-sections of $<10 \text{ mm}^2$.

The phase sequence of all low voltage installations is L1-L2-L3 (clockwise rotating field). However, by way of derogation from the mentioned specification, we request a five-pin input for each machine and system, i.e. the PE and N conductor is supplied separately. This input must provide the option to place a terminal link between the N and PE conductor (creating a PEN).

For the plants in America, 480V, 60 Hz applies. This must also be considered when selecting the devices.

Next is to be considered, that Machines up to 63A are to be constructed, that they can be connected with an CEE-Plug without further ado. That means:

- Machines $< 16\text{A}$ has to be constructed for 16A pre-Fuse
- Machines $>16\text{A}$ and $<32\text{A}$ has to be constructed for 32A
- Machines $>32\text{A}$ has to be constructed for 63A

1.5.1.2 Compressed air supply 6 - 10 bar

The pressure of the compressed air network is 7 bar, though it can vary between 6 to 10 bar within an area. The system and machine functions powered by compressed air must be designed in such a way that reliable function at a system pressure of 6 bar is ensured.

According to ISO 8573/1-2.4.3 (dust, water, oil), we guarantee a pressure dew point of 3 – 5 °C in our compressed air network.

1.5.2 Areas with dust exposure

Due to dust exposure (protection zone 22) in the polishing shop, the protection class of the electrical installation must be at least IP54. Fluorescent lamps must be equipped with a safety starter or have no starter at all.

1.6 Preliminary test / progress control

To avoid cost and time intensive corrections, it is advisable to perform a preliminary test at manufacturer's facility prior to delivery of system / machine. This preliminary tests comprises the production of a predetermined quantity with subsequent quality control. System is only delivered after a successful preliminary test has been performed.

1.6.1 Final inspection / acceptance

Final inspection takes place in the plant. It comprises function test of operational machine/system and compliance with the demands from this contract document and the requirements list. The basis for the final

inspection is the enclosed acceptance report and / or tool check list, plus an energetic decrease. A non-conformance report is prepared by final inspection. Appendix 4.2. contains a non-conformance report form. If non-conformances are not rectified by the contractor after a reasonable period, the customer reserves the right to have them rectified at contractor's expense! Hidden defects, e.g. errors in the circuit diagram, documentations must be corrected free of charge, even after expiration of the warranty period. During final inspection, the memories of the control components must be deleted and restarted with the provided backup copies. This process must be recorded in the report.

1.7 Design data

The contractor undertakes to provide the customer with absolutely all data, programs and plans required for building and operating the machine / system. In the event that data, programs and plans are created via PC, we request the corresponding files indicating the software used to create them and a version on CD-ROM in the same format.

During the design phase und assembly, the customer is to be provided with all available design data available for the current design status upon request. After commissioning, the customer is to receive the entire design data.

In doing so, all data should be provided in the standard PDF format if possible.

1.8 Risk analysis

According to Machine Directive, Appendix 1, the manufacturer of the machine undertakes to perform a risk analysis. It must be handed to the customer latest when the documentation is delivered.

1.9 Training on operation

The contractor will provide customer's employees with basic training on operation of the system / machine and troubleshooting. For this purpose, a quick start guide or training material is to be prepared. The content of the training and names of the participants must be recorded in a document.

1.10 Surface requirements

Articles that, for instance, require paintwork shall not be contaminated with components containing silicone (adherence of paint is no longer ensured). This means that feed lines, seals, interior seals, etc. containing silicone shall not be used when building the system.

1.11 Component identification

For identification of components, engraving units should be preferred. Selection of the manufacturer (Borries or Butzbach) is to take place according to article and under consideration of cycle time (embossing is faster). In addition to engraving units, embossing units can also be used after corresponding examination.

1.12 Warranty

The warranty for a delivered system/machine begins after successful acceptance. The supplier must respond to a malfunction during regular work hours on the next working day. We must be informed about the regular work hours.

1.13 Company logos

Company logos or logotypes are not permitted on systems and machines. The exception to this is legally required information (e.g. type plate).

1.14 Machine Colors

The machine colors has to be Red (RAL3020) and Grey (RAL7031). The use of the colors for the different

machine parts has to be discussed individually.

2 Electrical equipment

Compliance with the EN 60204-1 guidelines, including the recommendations contained therein, is required even if the machine, by its nature, is not affected by this regulation.

Switchgears, control concepts and machine or system installations must meet the following criteria:

- ▶ **Maximum safety for persons and machine**
- ▶ **Maximum operational safety**
- ▶ **Maximum availability**
 - i.e. already at time of electrical design the characteristics:
 - quick fault finding
 - quick troubleshooting
 - good repair options
 - must be taken into account.

The requirements for these criteria are specified below.

2.1 Design of installations

2.1.1 Protection, installation and designation of cables and lines

In principle, an optimal protection for cables and lines must be provided in the area of machines and production equipment. Following is a list of the essential points:

a) Protection of cables and lines

- ▶ against trampling
- ▶ on sharp edges
- ▶ during rotary movement
- ▶ during lifting
- ▶ when there is a risk of cutting

b) Installation of cables and lines

- ▶ Provide end-ferrules when installing pipes
- ▶ Provide edge protection with metal ducts
- ▶ In tread area/access area always use metal ducts with step protection
- ▶ When using plastic ducts, feed from the bottom (prevent foreign matters from entering)
- ▶ Observe bending radii
- ▶ Ensure strain relief (e.g. tighten screw connections, clamp connections)
- ▶ Provide space reserves in conduits and ducts (see 2.2.8)
- ▶ Connect cable shields in accordance with standards or manufacturer information
- ▶ "Open air wiring" is to be avoided
- ▶ Installation in frame constructions are only permitted after consultation

c) Identification and connection of cables and lines

- ▶ The equipment identification is to be placed directly on the sensor/actuator
- ▶ The equipment identification must be permanent, resistant against wiping and oil
- ▶ Per terminal, only one wire is allowed
(Exception: Two wires in a double-end ferrule with potential loops)
- ▶ In principle, wire end ferrules or cable lugs shall be used
(Exception: With spring terminals => observe manufacturer information)
- ▶ Line connectors in cable ducts, cable racks and installation pipes are not permitted

- ▶ Bundling of cables and lines in cable racks and installation pipes is not permitted
- ▶ Cables has to be labled on both sides

2.1.2 Suitability of cables and lines

All cables and lines must be selected and used for the respective application (resistance against oils and lubricants, temperature, tractive capability). Cables and lines must always feature flexible conductors. In the production area of the BPT, do not use silicone cables.

When installing lines in areas that come in contact with cooling lubricants, emulsions or similar substances, e.g. in saws, drilling machines, special machines, etc., the following or equivalent line types, 400P or 400CP (Lapp) or PUR lines shall be used.

2.1.3 Drag chains

When using several lines in a drag chain (specifically during simultaneous installation of hoses and electrical lines), separators must be applied. Both sides of the lines must have strain relief. In the chain, lines with tractive capability must be used and the drag chain may only be filled up to max. 75%. In addition, the assembly instructions of the manufacturer must be observed.

2.1.4 Potential equalisation / protective conductor

Conductive system and machine parts must be connected with the protective conductor according to EN 60204-1 (VDE 0113) Section 8. In consideration of possible welding currents we request a minimum cross-section of 25 mm² for the connection of individual machine bodies, even if according to EN 60204-1 (VDE 0113) a smaller cross-section would be sufficient

2.1.5 Valve control

Valve controls must be designed for 24 V/DC. The valve coils must be connected via plug connections and equipped with surge protection circuits as well as indicator lamps. For surge protection, varistors should be used.

Maximum 8 valves (on single valve circuits) may be protected by one fuse. The power consumption of the valve coils should be as low as possible. If valve terminals are applied, use fuses in compliance with manufacturer's specifications.

2.2 Design of switch cabinets, control panels and terminal boxes

2.2.1 Type plate

Each system must be equipped with a type plate as per EN 60204-1 (VDE 0113) section 17.4. Attach this type plate to switch cabinet in such a way that it is clearly visible from the outside. Do not bolt or rivet (protection class).

2.2.2 Setup of switch cabinets

When setting up switch cabinets, the following requirements must be met in addition to the rules of engineering and the demands of the corresponding DIN, EN or UL standards:

- ▶ Switch cabinets shall be set up in such a way that the back can be placed against a wall
- ▶ When switch cabinets are positioned on the floor, a base of 200 mm is to be provided
- ▶ Switch cabinets positioned on the floor must be fastened to it
- ▶ The lines are fed into the switch cabinet from the bottom
- ▶ All lines fed into the switch cabinet must be supported (cable support rail or screw fittings)
- ▶ All fed lines shall be laid over terminals (Exceptions must be coordinated with us, e.g. servo lines)
- ▶ Shielded lines must be laid over a shield rail and then grounded centrally
- ▶ All mounting plates, side walls, base plates and cover plates must always be grounded
- ▶ The distance between line ducts and components must be at least 20 mm (if component manufacturers request larger distances, they must be complied with)
- ▶ It is not permitted to equip side walls and the ground with components
- ▶ Sufficient switch cabinet lighting must be provided.

(Tap in front of main switch and with door contact switch)

- ▶ A service plug socket (230V) must be provided (not required for America)
- ▶ A sufficiently large drawing tray must be provided for the circuit diagram
- ▶ Completely installed switch cabinets must have a minimum protection class of IP54
- ▶ On systems that produce oil mist due to cooling lubricants or the like, the use of switch cabinet air-conditioning must be coordinated with the plants!
- ▶ On systems with pre-fuse more than 63 amps has to be installed a measurement device for the power consumption (kilowatt hour meter, see 2.6.1 power supply systems). If there is an Ethernet-Interface, use a Switch with one free Port for the kilowatt hour meter.

2.2.3 Setup of panels and operator stations

- ▶ The installation of round command and indication units is performed exclusively in \varnothing 22.5 mm openings
- ▶ Operator units (OP, TP, etc.) must be installed according to manufacturer information
- ▶ Vertically opening doors and panel plates must be equipped with stops
- ▶ All doors and flaps must be provided with double-bit key locks
- ▶ Operator stations must be arranged in such a way that all motions initiated by them can clearly be seen by operator
- ▶ The application of mobile operator stations must be coordinated with the plugs
Only use these combinations
Han 6E-bu-s/09 33 006 2701 **and** Han 6E-sti-s/09 33 006 2601
Han 6B-gs-M20/19 30 006 1540 **and** Han 6B-asg1-LB-M20/19 30 006 1250
- ▶ Minimum protection class of IP 54
- ▶ Cables dragging across the floor are not permitted

2.2.4 Function texts on front and panel plates

Any equipment installed in switch cabinet doors, panel plates, front plates of control boxes that is used for control, indication and display, etc. must be provided with a function text in the corresponding language, e.g. "control voltage On", "circulating pump On", "overtemperature belt drive" etc. Function texts must always be on engraved Resopal plates with black letters on light background.

2.2.5 PG-interface

Arrangement, number and site of interfaces for PLC, CNC or other controls must be coordinated with the plants.

2.2.6 Setup of terminal boxes

- ▶ Terminal boxes must have a minimum protection class of IP 54
- ▶ Terminal boxes must be sufficiently dimensioned for later additions
- ▶ Unused cable entries must be sealed in accordance with the applied protection class
- ▶ Lines in connection boxes shall not be looped through
- ▶ When using sheet steel housings, mounting plates, doors and housings must always be grounded
- ▶ Terminal boxes size 100mm x 100mm and larger must be equipped with foldable doors
- ▶ Vertically opening doors must be equipped with stops
- ▶ The designation of the interior terminal strip is on the cover of the terminal boxes
To be applied clearly visible (min. font size 50mm, resistant against wiping and oil)
- ▶ Plastic housings are not permitted (exception: anodising area and powder coating)

2.2.7 Colour scheme of wiring

The colour scheme of wiring is to be performed according to EN 60204-1 (VDE 0113) Section 14.2.4.

Main circuits with alternating or direct current	black
Control circuits with alternating current (phase)	red
Control circuits with alternating current (reference)	red/white

potential)	
Control circuits with direct current (L+)	blue
Control circuits with direct current (L-)	blue/white
Neutral conductor (N)	light blue
Conductors still carrying voltage when main switch is switched off, (e.g. tap in front of main switch, lock with other systems)	orange
Measuring lines	white

The colour scheme of wiring is to be performed according to UL-Standard:

Main circuits with alternating current (phase)	Black
Main circuits with alternating current (reference potential)	white or gray
Unless circuits: Grounded	Orange
ungrounded	White with orange Stripes
Control circuits with alternating current (Phase)	Red
Control circuits with co-current flow (L+)	Blue
Control circuits with co-current flow grounded	White with blue Stripes

2.2.8 Reserves

After commissioning, the following space reserves must be available for later expansions:

25 % space reserve	in the area of fused outgoing circuits
25 % space reserve	in the area of switchgears and controls
25 % space reserve	in line ducts and drag chains
25 % space reserve	on control and operating panels
25 % space reserve	between the individual terminal strips and in terminal boxes
30 % space reserve	on cable trays and in cable conduits within the machine/system
100% Space reserve	on cable trays mounted outside the machine/system (e.g. as connection between system parts)
50% Space reserve	in cable conduits mounted outside the machine/system (e.g. as connection between system parts)
50% Space reserve	in openings for cable feedthrough
10% Space reserve	in lines of switchgear combinations to terminal boxes (per cross-section)
25% Space reserve	PLC assemblies
25% Space reserve	Memory of control assemblies
20% Power reserve	for power supply units

20%
Reserve wires

Control lines

2.3 General requirements and information on electrical equipment

2.3.1 EMERGENCY STOP switch

EMERGENCY STOP switches must be provided in sufficient number, but at least at every operating and handling site in places that can be accessed without danger. They must be mounted in such a way as to prevent unintentional operation (if necessary, use key enclosure with "collar"). In order to be able to expand the EMERGENCY-STOP circuit, terminals must be provided in the switch cabinet for at least two additional EMERGENCY STOP switches (if not in use, they are bridged).

2.3.2 Heat dissipation

The heat generated in the switch cabinets and control boxes due to power loss must be reliably discharged. To calculate the thermal balance, a max. ambient temperature of 35°C is generally to be assumed. According to the calculated total power loss, respective heat exchangers, forced ventilation or air conditioning units shall be provided.

In case of forced ventilation, filters must be applied that safely prevent oil mist and dust from entering => up to P54 possible. The change intervals of the filter mats must be indicated.

When using air conditioning units or fans, they shall not be controlled in continuous operation but rather based on the temperature inside the switch cabinet and a door switch (switching off when door is open).

Furthermore, when using air conditioning units there must not be any formation of condensed water in the switch cabinet!

When devices with large heat generation are applied (e.g. cooling devices for milling spindles), they must be mounted separately from the other control in individual switch cabinets or be uncoupled from the remaining switch cabinet by a bulkhead partition.

The protection class of the selected cooling must match the one of the switch cabinet.

The removal side of a system must be free from cooling device intakes (due to the frequent dust development, e.g. during deburring)

2.3.3 Motor protection

In principle, all motors require separate protection and switching! Thus, connection of several motors to one motor circuit breaker and switching by one contactor are not permitted. The same applies to motors that are supplied via frequency converters, i.e. each motor must have its own frequency converter and its own main fuse.

Motor feeders must be protected by means of a motor circuit breaker (power switch). Overcurrent relays are not permitted. The setting values of the motor circuit breakers must be indicated in the circuit diagram at the symbol.

Motors in alternating load operation (more than 20 load changes / h) or intermittent operation (more than 10 starts / h), must either be over-dimensioned by 30% or feature full motor protection, i.e. additional PTC resistor temperature sensors in the stator windings.

Drives operated via a frequency converter or a soft starter must always be equipped with PTC resistor-temperature sensors. Furthermore, converter-fed three-phase motors that operate continuously < maximum speed, must be dimensioned accordingly or equipped with forced cooling.

Drives with a nominal power above 30kW must also be equipped with PTC resistor-temperature sensors. For drives that are mass-produced and feature an equivalent protection, an exception can be agreed on in writing.

Electrical Drives in machines for the United States, has to be generally operated by frequency converters.

2.3.4 Motor start

Motors with a nominal power up to 7.5 kW can be started directly. Above 11 kW a star-delta-start-up is required. The use of soft starters is to be coordinated with the plants.

2.3.5 Surge protection

Inputs from switchgears containing electronic equipment must feature a suitable surge protection.

In switch cabinets with electronic equipment, all contactor and relay coils must feature surge arresters. A coil voltage of 24 V requires the use of varistors, a coil voltage of 230 V the use of RC wires.

Surge arresters for valve coils, see 2.1.5

2.3.6 Shielding

All lines that transmit measuring signals must be selected in shielded version. Shielding must be carried on a common potential-free rail that is connected via **one** line with the PE potential.

Converter-fed motor lines require shielded installation and shielding must be grounded in accordance with manufacturer regulations.

To prevent circuit feedback as far as possible, frequency converters must always be selected or equipped with so-called EMV-modules.

2.3.7 Data transmission

As bus systems at field level, Profibus and ASI-bus can be used.

Data transmission to higher-level systems must be adapted to the existing conditions and definitely coordinated with us. Preferably, an Ethernet topology with reports TCP/IP or RFC1006 is to be provided.

Analogue signals should preferably be in 4 – 20 mA.

2.3.8 Control with high switching rate

If switching rate is above 1 Hz during the control of actuators, control must always be contactless.

2.3.9 Control voltage

The control voltage applied for auxiliary circuits should preferably be 24V DC.

2.3.10 Mobile equipment

Mobile electrical components (e.g. vacuum, chip conveyor, etc.) of a machine must be connected via plug / plug socket combinations. In doing so, a cable type of min. H07 RN-F or equivalent is to be provided.

2.3.11 Working area lighting / workspace lighting

The working area of a machine must feature lighting in accordance with DIN EN 1837. Non-glare must receive particular importance.

2.3.12 Laser products

When using laser products it is absolutely necessary to observe beam direction, if possible only to acquisition centre; if subject to voltage, possibly switch off via safety door switch.

2.4 Availability, fault finding, troubleshooting

Quick fault finding and repair require the following:

- ▶ Clear control concept
- ▶ Adequate status and malfunction indication
- ▶ Good accessibility of peripheral components
- ▶ Meaningful and clear documentation
- ▶ Complete device designations
- ▶ Diagnostic program in PLC controls
- ▶ When using bus systems, the indication of all inputs/outputs must be available via an OP/TP surface.

2.4.1 Control concepts

2.4.1.1 PLC / control

The design and implementation of a system or machine control is subject to the following requirements:

- ▶ Program structures must be clearly divided into functional units
- ▶ All operands used within a program must have meaningful comments
- ▶ In case of sequence control, a higher-ranking step level (step-chain) must be provided (for the step change, only the step enabling condition is decisive (see DIN 40719, Part 6))
- ▶ Flags and outputs shall only feature a bit-allocation or a set- reset command (Exception: Initialisation procedure)
- ▶ Programs and data may not be blocked by software protection
- ▶ Password specifications and password level must be coordinated with WEA
- ▶ PLC programs must be created either as ladder diagram or logic diagram
- ▶ The development of PLC programs shall be based on the standard of the WKW Group (a sample program will be made available)
- ▶ Combining several signals onto one PLC input is not permitted

2.4.1.2 CNC control

CNC programs must be designed in such a way that machining processes divided into groups can quickly and easily be changed by trained personnel. The group assignment is structured by a main program and possibly several subprograms if permitted by the existing control.

The main program contains all technological data, such as zero offsets, plant data, speeds, comments, feed rate and subprogram calls. The subprogram should - if possible - contain only the coordinates output. Likewise, whenever possible, subprograms should be assigned a letter and an ascending number (example: L101, L102 etc.).

The exact description of the subprogram is contained in the main program in form of a comment block (example: „L101 = END TRIMMING LEFT END C-COLUMN“).

Offsets of subprograms must be performed via zero offsets in the main program and apply only to the next subprogram call. Each system has a measurable zero point reference that serves as reference for each CNC program.

Each NC block starts, whenever possible, with a block number and is sorted in ascending order.

Each main program starts with a comment line, containing the word „FILE NAME“. This comment line ends with the decimal point, colon and a 15-digit designation code.

The designation code consists of the following specifications:

1-8 digit = article description (article number)

9-10 digit = counter

11-13 digit = classification key

14-15 digit = application key

In principle, preference is to be given to absolute value programming. (G90)

Program documentation:

Each CNC program consists of a setting sheet that shows the position to be machined. This setting sheet also must include the program sequence and block number responsible for a zero offset.

Example for a main program

```

; FILE NAME      : 1234567812123CA           Comment line with designation code
; DESIGNATION   : C216 SUPPORT RAIL STRAIGHT ROD   Comment line with article description
.....
N0010 L654                                           possibly call up zero-point loading program
.....
N0070 T1 M6 ; WKZNR:52 SCHAFTFRAESER_4MM   Tool call and description
N0075 D1 S12000 M3 M8 F5000                 Load technology data
N0080 TRANS X-0.02 Y-0.15 Z0.03            Zero offset for subprogram „L101“
N0085 G00 X292.664 Y160.03 Z290.12         Move to pre-position

```

N0090 L101	Call up subprogram for L101
N0095 TRANS X0.00 Y-0.01 Z0.1	Zero offset for subprogram „L102“
N0100 G00 X6435.032 Y-640.471	Move to pre-position
N0105 L102	Call up subprogram for L102
.....	

Example for a subprogram
L101.SPF

```

.....
N0005 G00 Z127.6
N0010 G01 X292.664 Y160.03 Z125.5 F5000
N0015 G41 G01 X289.002 Y156.927 F2500
N0020 G01 X300.296 Y143.127
N0025 G01 X295.4 Y136.632
N0030 G40 G01 X299.233 Y133.742
N0035 G00 Z127.6
.....

```

All possible deviations or machine-related changes must be coordinated with VCNC Department.

2.4.1.3 Remote maintenance

Remote Access to machines from outside the plants is only permitted via VPN-Tunnel.

2.4.1.4 Profinet-device identity

The **WEG (WKW Engineering GmbH)** must be contacted for the assignment of the Profinet device identity. The reference is the document „Profinet-device identity“.

2.4.2 Operating modes

Depending on size and complexity of system or machine, various operating modes can be applied. The required operating modes related to the system are defined with the contractor and their function is stipulated. In case of several operating modes, the machine/system must be protected against unauthorised change of operating mode (key switch or password). The following operating modes with their specific properties are possible:

2.4.2.1 Automatic operation

Specific properties:

- ▶ Selection via command unit or operator unit
- ▶ Start of automatic sequence from home position via command unit
- ▶ Movements are carried out with the „Automatic speeds“
- ▶ All locks are active (personal and system protection)
- ▶ Indication of „Automatic“ operating mode via indicator light (continuous light) or on operator unit
- ▶ Error and run time monitoring are active

2.4.2.2 Manual operation

Specific properties:

- ▶ Selection via command unit or operator unit
- ▶ All system functions are performed via command units
- ▶ Movements are carried out with the „Automatic speeds“
- ▶ Movements are carried out until the respective end position is reached
- ▶ All locks are active (personal and system protection)
- ▶ Indication of „Manual“ operating mode via indicator light (continuous light) or on operator unit
- ▶ Error and run time monitoring are active
- ▶ With servo axes it could be practical to operate at reduced speed

2.4.2.3 Setting up mode (manual mode without safety)

Specific properties:

- ▶ Selection only via secure key switch
- ▶ All system functions are performed via command units
- ▶ Movements are carried out with the „Setting up speeds“
- ▶ Movements are only carried out as long as the command unit is operated
- ▶ It is only the emergency stops (they require system-related definition)
- ▶ Indication of „Setting-up“ operating mode via indicator light (continuous light)

2.4.2.4 Move to home position (straightening operation)

Specific properties:

- ▶ Selection via command unit or operator unit
- ▶ After start via a command unit, all units move to their home position in logical order
- ▶ Movements are carried out with the „Automatic speeds“
- ▶ All locks are active (personal and system protection)
- ▶ Indication of „Straightening“ operating mode via indicator light (continuous light) or on operator unit
- ▶ Error and run time monitoring are active

2.4.3 Messages

All system states and causes of malfunctions must be indicated via indicator light or plain text on the operating unit. Additional requirements are listed below:

- ▶ Plausibility check of all alternatively operated locators (e.g. safety door OPEN / CLOSED)
- ▶ Run-time monitoring of all time-constant movements (e.g. cylinder movements)
- ▶ All malfunctions must be stored until they are acknowledged by the command unit
- ▶ When using indicator lights, a lamp test button must be provided

2.4.4 Protection of peripheral components

For the purpose of quick fault localisation of a short circuit, supply lines of sensors and actuators must be separately protected in groups. In the process it must be ensured that, when using higher-level protection, the selectivity is guaranteed. It is absolutely essential that all protections requested by the component manufacturer are complied with. Separate fuses (minimum requirement) are requested for the following circuits:

- ▶ All power circuits
- ▶ Control voltage in general
- ▶ Control voltage after EMERGENCY STOP
- ▶ PLC inputs
- ▶ PLC outputs in general
- ▶ PLC outputs for pneumatic and hydraulic valves

2.4.5 Accessibility and protection of peripheral equipment

The following requirements are made on protection and accessibility:

- ▶ Good and safe accessibility
- ▶ Existing indicator lights must be visible
- ▶ When installed, sensors and actuators must have a min. protection class of IP65

2.5 Documentation

In principle, each machine and system is to be delivered with its **own** documentation, including all related documentation parts! This also applies to systems/machines that are of identical design (e.g. machines for machining right and left parts of a series).

In addition, clear marking is required, specifically on machines for machining right and left parts of a series.

Concerning documentation, we request the following material:

- ▶ 2 x set in paper version
- ▶ 1 x complete set on CD-ROM
- ▶ Caddy drawing system as standard; PDF in case of deviations

2.5.1 Circuit diagram

The circuit diagrams must be prepared according to DIN 40719, Part 3, for maintenance purposes. The circuit diagrams must have a cover sheet, table of contents and a sheet for revision notes in front.

Following are additional requirements that we make on circuit diagrams:

- ▶ Enter drawing/project number in standard sheet
(the drawing/project number is assigned by us and must be requested)
- ▶ Power, control and signal circuits must be shown isolated and with all poles
- ▶ All contact configurations and cross references must be entered
- ▶ Current paths must be numbered and labelled
- ▶ Functions must have explanatory text
- ▶ Site and system identification must be coordinated with us
- ▶ Equipment identification should be subject to sheet and current path
- ▶ Settings of DIL switches must be recorded

2.5.2 Connection diagrams (terminal diagrams)

The terminal diagrams must be in accordance with DIN 40719, Part 9. The standard sheet (title block) must contain the drawing number/project number, which must be requested from us.

2.5.3 Installation plans (cable diagram)

According to EN 60204-1 (VDE 0113), Section 18.5, installation plans must contain the following information:

- ▶ Total connection value of machine or system
- ▶ Type, cross-section and number of wires of cables and lines to be installed
- ▶ Cable or line number
- ▶ Direction designation of cables or lines (e.g. X1, 3M2, 1Y4 etc.)

On large systems, cables or lines and system components can also be shown in lists. The list must contain all of the above mentioned data.

2.5.4 Descriptions

The operating instructions, service documents, device manuals of all devices and assemblies in use are preferably to be provided on CD.

The operating instructions must contain all necessary information on how to bring the machine in home position or perform a restart after a malfunction.

2.5.5 Maintenance and maintenance intervals

The content structure of the maintenance instructions shall be according to EN 60204-1 (VDE 0113). In addition, the following information is requested:

- ▶ Information on inspection of safety equipment
- ▶ Information on inspection of energetic maintenance (compressed air)
- ▶ Description on protection of operating systems, programs and data
- ▶ Replacement instruction for devices that require a specific procedure
- ▶ Spare parts order data from the manufacturer, and not the machine builder, must be part of the documentation.

2.5.6 Parts lists

The content structure of the parts list shall be according to EN 60204-1 (VDE 0113). The parts lists shall be created separately for the equipment in switch cabinets, control panels, control boxes and for peripheral equipment. All the data required for order placement must be listed.

2.5.7 Spare parts list

The spare parts list is a recommendation by the supplier for stocking the necessary and important assemblies. The structure of the spare parts list shall provide the following information:

- ▶ Name / designation
- ▶ Manufacturer / supplier
- ▶ Type / material
- ▶ Order information for purchased parts
- ▶ Number of components used
- ▶ Price (at the time of creation)
- ▶ Delivery time (at the time of creation)
- ▶ Recommended quantity to be stocked

The spare parts list can also be structured as subset of the parts list, by adding the corresponding information to the parts list.

2.5.8 Software documents

The following documents are required:

- ▶ **Program list**, preferably in LAD or FBD
- ▶ **Assignment list**, for all operands, with clear and easy to understand comments.
- ▶ **HMI-program files** (when using an OP or the like.)
- ▶ **Parameter lists** of frequency converter, Robots on a data storage medium

If programs are created in a high level language, the source texts and the libraries of the documents must be added on data carriers. In addition, the high level language, including version, must be mentioned.

The required data carriers must contain the programs required for control and documentation, according to the current state.

For the purpose of checking, the respective program parts are transferred to one of the customer's programming units after commissioning, and compared with the actual status in the control.

2.5.9 Configuration, parameterisation

When using devices or assemblies (e.g. controllers, OPs, measuring transducers, converters) that can be configured or parameterised, the set parameters must be indicated.

If Profibus nodes are used, the required device drivers (GSD files) must be provided. If this parameterisation can be performed via PC, the set parameters must be added to the documentation on a data carrier.

If the above mentioned assemblies require special programs for parameterisation and data transfer or backup, they must be provided in the original version. This includes, among others, licenses, manuals and system descriptions, installation discs/CDs, boot discs/CDs, drivers used, the description of structure/file storage as well as interfaces.

2.5.10 Test certificates

All test certificates, such as installation certificate, insulation and voltage tests, etc. must be added to the documentation (see also 1.2) and handed to the customer prior to commissioning.

2.6 Device selection regulation

All applied devices and assemblies may only be used in their original state and without any modification. Specifically prohibited are the drilling out of mounting holes, changing configuration or contacts and removing housing parts.

If devices or assemblies are to be used that are not listed in this device selection regulation, their use must be coordinated with us in writing!

2.6.1 Power supply systems

Component	Make	Type	Note
Busbar system	Rittal, Wöhner		
Load current supply 24V DC	Siemens, Phoenix Contact	SITOP Power and PS series	
Kilowatt hour meter	Fa. Berg	model : UBN40 80A LAN SN : K542QA0001 model : UBN40 &A LAN SN : K442QA0003 model : UBN40 RGW LAN SN : K642QA0008	

2.6.2 Power switch

Component	Make	Type	Note
Main switch	Moeller	not specified	medium switching capacity
	Siemens	not specified	medium switching capacity
motor protection switch	Siemens	3RV... (SIRIUS)	for mounting switch cabinet
	Moeller	PKZ M0-...	only for on-site installation

2.6.3 Command and indication units

Component	Make	Type	Note
Button, indicator light	Moeller		
Rotary control button, switch	Moeller		
Indicator lamps	- Moeller - Siemens	Signal towers	
Emergency stop	- Moeller - Siemens		conventional with AS interface
Foot switch	Bernstein		
Safety light barrier (BWS)	- Sick - Leuze electronic		

Comment: Hole diameter: \varnothing 22.5 mm, illuminate for indicator light 24V DC, incandescent lamps or multi LED; base Ba 9S

2.6.4 Position switch

Component	Make	Type	Note
Limit switch (mechanical)	Siemens Honeywell Schmersal Pepperl & Fuchs	not specified	must be in compliance with DIN EN 50041 and DIN 50047 permitted only in metal design!
Inductive proximity switches	preferably Siemens, ifm, ipf, Sick, Festo, Contrinex	not specified	Indication for switch state and with plug connection
capacitive proximity switch	preferably Siemens, ifm, ipf, Sick, Festo, Contrinex	not specified	Indication for switch state and with plug connection
Light scanner	ifm, ipf, Sick, Festo, Contrinex keyence (for special applications)	not specified	Indication for switch state and with plug connection
Safety switches	Siemens, Schmersal, Euchner PILZ	not specified not specified PSEN	Connection line with plug (PSEN cable)

2.6.5 Power contactors, auxiliary contactors and relays

Component	Make	Type	Note
Power contactors	Siemens		with screw fitting
Coupling contactors	Siemens		with screw fitting
Auxiliary contactors	Siemens		with screw fitting
Coupling relay	Siemens, Lütze, Phoenix Contact Weidmüller		with screw fitting
Time relay	Siemens or Schleicher		with screw fitting
Phase failure relay	Schleicher or Kriwan (see full motor protection)		with screw fitting
Emergency stop relay safety relay	Pilz	PNOZ	Voltage value 24V/DC
Two-hand safety relay	Pilz	PHZ	Voltage value 24V/DC
Safety door monitor	Pilz		Voltage value 24V/DC

2.6.6 Devices for acquisition of non-electr. quantities

Component	Make	Type	Note
Speed monitors	lfm, ipf		
Flow monitors	lfm, ipf		
Standstill monitors	lfm, ipf		
Thermistor motor protection	Siemens	3RN1 (3UN2)	
Full motor protection	Siemens or Kriwan		

Comment: A multi-motor protection device is only permitted when all motors of this group can or must be switched off in case of motor failure!

2.6.7 Automation devices

Component	Make	Type	Note
PLC	Siemens S7	S7 -300; S7-400; S7 -1200; S7 - 1500	
Central assemblies	Siemens	depending on requirement	observe storage space
Digital input cards	Siemens		
Digital output cards	Siemens		
Analogue assemblies	Siemens		
Profibus assemblies ext. periphery	Siemens		
Asi assemblies ext. periphery	Siemens, ifm, Biehl + Wiedemann		

Important information: Crimp connections will not be accepted!

2.6.8 Machine operation, visualisation

Component	Make	Type	Note
Text displays	Siemens		
Operator Panel	Siemens		
Touch-Panel	Siemens		

2.6.9 Motors

Component	Make	Type	Note
Three-phase motor		Standard motors	use at least insulation class F and Energy efficiency grade IE2/IE3 min. IP 54
Servo motor	Siemens	1FK7063-5AH71-1FH0-ZN05 (with absolute encoder)	Transfer application
Servo motor	Siemens	Upon consultation (with absolute encoder)	Milling application

Comment: Any use of non-standard motors must always be discussed with us

All motors from 0.75 kW has to be IE3. IE2-Motors has to be controlled via frequency-converter.

2.6.10 Drive technology

Component	Make	Type	Note
Frequency converter	Siemens	SINAMICS G120	
	SEW	Movitrac	
Servo controller	Siemens	SINAMICS S120	

2.6.11 Installation material

Component	Make	Type	Note
Switch cabinets a. accessories	Rittal, Sarel		
Terminal material	Weidmüller		
Fuses	Siemens, Moeller		
Surge protection	- Dehn - Phönix Contact - Weidmüller		
Drag chains	Igus		
Plug and socket devices	Harting Ilme	Han E, screw fittings	Use in the system Use in the switch cabinet

3 Mechanical part

All aggregates or third-party components must be fitted in such a way that they are easy to maintain, repair and access, to allow our maintenance personnel to perform replacement without the use of special tools. In addition, the following requirements must be met:

- ▶ Provide sufficient working space for cleaning, maintenance and replacement of components
- ▶ Provide catch basins for draining liquids
- ▶ Purchased parts must be used in their original state
(in case of necessary changes, a comprehensive documentation is required)
- ▶ Labelling of all hydraulic, pneumatic and lubrication components
(according to the designations in the respective circuit diagram)
- ▶ The labelling must be resistant against wiping, oil and temperature
- ▶ Lubrication points, lubricating nipples, oil filler necks, etc. must be marked with red colour (see lubrication chart for lubrication intervals).
- ▶ Compressed air may not be „misused“ for cooling purposes!

3.1 Design of installations

3.1.1 Installation, protection and designation of pipe and hose lines

An optimal protection for pipes and hoses must be provided in the area of machines and production equipment. The path of pipe and hose routes must be selected in such a way as to rule out any exterior damage.

3.1.2 Transportation

For transport purposes, the machine, its auxiliary equipment or components to be transported individually must be equipped with suitable aids in compliance with accident prevention regulations (e.g.: eye-bolts according to DIN 580, openings for transport bars, stationary hooks or eyelets,...)

Mounting of aids requires an explanation via visual representation in a transport instruction. This instruction must also be added to the documentation.

3.1.3 Setup and fastening

The fasteners required for setup, such as anchor bolts, levelling elements, heavy-duty dowels, etc. must be included in delivery or reported to us. The position of protective barriers must be coordinated with the customer.

If grids, stairways or steps with anti-slip grades are used during assembly of the system / machine, they must have an anti-slip class of at least R12.

3.1.4 Setup of devices, tools and special machines

3.1.4.1 Stamping tools

The setup must be according to the enclosed check list (see 4.5).

3.1.4.2 Tensioning elements

The design of tensioning elements must be considered on an individual basis, depending on article and requirements, and specified in coordination with the plants (e.g. eroded, moulded, etc.).

3.1.4.3 Cooling lubricants

Depending on application and amount of chips, it is determined with the plants whether minimum quantity lubrication or circulation lubrication will be used.

3.1.5 Cleaning

To facilitate cleaning, chip extractions, guide plates, etc. must be intensively contemplated, accordingly planned and designed with the production plants. The result will be documented in writing.

3.2 Documentation

Concerning documentation, we request the following material:

- ▶ 2x set in paper version
- ▶ 1x set on CD-ROM

3.2.1 Operating instructions

The operating instructions, service documents and device manuals of all devices and assemblies must be provided on CD.

3.2.2 Drawings

The documentation must include all drawings of the system / machine. The drawings must be detailed in such a way that all components are recognisable. We reserve the right to request drawings free of charge even after expiration of the warranty obligation. The assembly drawings must be provided with dimensions. For non-standard wear and spare parts, component drawings must be included in the documentation. Whenever possible, the drawings should be provided in original format. Reductions are only accepted when clarity and recognition of details are ensured. The complete design (3D) must be handed to the customer on data carriers (see also 1.1).

The following file formats will be accepted: STEP, IGES, DXF (2D), Catia V4/V5.

3.2.3 Hydraulic plans

The hydraulic plans must be created according to DIN. All components in the system must be permanently and legibly marked with labels. These equipment markings must match the information in the parts lists and hydraulic plans. For improved overview we request uniform marking of sensors and actuators in the hydraulic plan and circuit diagram.

3.2.4 Pneumatic plans

The pneumatic plans must be created according to DIN. All components in the system must be permanently and legibly marked with labels. These equipment markings must match the information in the parts lists and pneumatic plans. For improved overview we request uniform marking of sensors and actuators in the pneumatic plan and circuit diagram.

3.2.5 Maintenance instructions

The maintenance instructions or maintenance plan must include detailed information on the maintenance activities to be performed and maintenance intervals. The document listed in appendix 4.5 shall be used.

3.2.6 Lubrication charts

If the system / machine requires lubrication, a lubrication chart must be included in the documentation. The lubrication chart must have at least the following content:

- ▶ Overview of position of all lubrication points in the system
- ▶ Information on lubrication work
- ▶ Information on lubricants used
- ▶ Lubrication intervals to be maintained

(see Lubrication chart 4.1.5 in appendix)

3.2.7 Parts lists

The parts list shall allow the maintenance staff to procure a spare part without having to remove the original part. Purchased parts must be marked accordingly in the parts list. All the data required for order placement must be listed! **The parts list must contain the data of the components that are used in the system / machine!** The structure of the parts list shall provide the following information:

- ▶ Reference to drawing (drawing no.)
- ▶ Positions no. / component designation
- ▶ Name / designation
- ▶ Manufacturer / supplier
- ▶ Type / material
- ▶ Order information for purchased parts

3.2.8 Spare parts lists

The spare parts list serves as recommendation by the supplier for stocking the necessary and important assemblies. The structure of the spare parts list shall provide the following information:

- ▶ Name / designation
- ▶ Manufacturer / supplier
- ▶ Type / material
- ▶ Order information for purchased parts
- ▶ Number of components used
- ▶ Price (at the time of creation)
- ▶ Delivery time (at the time of creation)
- ▶ Recommended quantity to be stocked

The spare parts list can also be structured as subset of the parts list, by adding the corresponding information to the parts list.

3.3 Device selection regulations

If devices or assemblies are to be used that are not listed in this device selection regulation, their use must be coordinated with the plants in writing!

3.3.1 General mechanical components

Component	Make
Gear motors	Bauer, Lenze, Getriebebau Nord, SEW
Linear guides	REXROTH Star
Ball-screw spindle	REXROTH Star
Oil air filter	Mann&Hummel, Hydac, Eppensteiner

3.3.2 Hydraulic components

The following makes can be used for hydraulic components such as valves, cylinders, pumps, swivel motors, screw fittings, filters, pressure switches, seals, measuring connections and quick connects:

Make
Bosch REXROTH
Parker
AHP Merkle
Eckart
Stäubli
Hydac
Ermeto
Eppensteiner
Busak & SHAMBAN
Stauff
THF
James Walker
EMB
Römheld, hydraulic clamp-systems
Stark, clamp systems

3.3.3 Pneumatic components

The following makes can be used for pneumatic components such as valves, cylinders, maintenance units, screw fittings, feed units and quick connects:

Make
Festo
Desoutter
C.K. Walther
IMI Norgren
Bahco
SMC

4 Appendix

4.1 Templates in EXCEL file <Anhang.xls>

4.1.1 Contacts

File: <Anhang.xls / Ansprechpartner>

4.1.2 Machine data sheet

File: <Anhang.xls / Maschinendatenblatt>

4.1.3 Spare parts list-Electrical

File: <Anhang.xls / Ersatzteilliste-Elektro>

4.1.4 Spare parts list-mechanical

File: <Anhang.xls / Ersatzteilliste-Mechanik>

4.1.5 Lubrication chart

File: <Anhang.xls / Schmierplan>

4.1.6 Agreements on deviations

File: <Anhang.xls / Vereinbarungen>

4.1.7 Energetic consideration of media

File: < Anhang Pflichtenheft WKW_EA_WEA_V01_4-1-7 Energetische Medienbetrachtung.xlsx / Vereinbarungen>

4.2 Template for inspection and acceptance certificates

- Acceptance report / list of defects
- Preliminary test report special machine
- Acceptance reports special machine
- Acceptance report CNC processing machine
- Acceptance stamping tools

4.3 Template for installation certificate

File: <Installationsbescheinigung.doc>

4.4 Template for type plate

Example for type plate on switch cabinet

Supplier:		Year of construction:	
Netzanschluss:	400V 3PH/N/PE 50 Hz	Total output:	kW
Full load current:	A	Short circuit breaking capacity:	kA
Vorsicherung:	A	Control voltage:	V

Drawing No:		Mach. No. :	
-------------	--	-------------	--

4.5 Checklist for devices and tools for presses

1. Indicate tool weight for heavy tools.
2. Have installation heights been complied with?
Dunkes press min. 510mm max. 1000mm
Bruderer press min. 270 max. 350mm
3. Is the tool with transport locks too high?
4. Are the transport locks made of metal?
5. Is there access for forklift forks?
6. In case of continuous base plate, is it free of recesses in the area of the roll block bars?
7. Are cables and hoses protected during transport?
8. Do safe tools have proper shielding?
9. When using safe tools, can the workpiece support and hold-down device still be cleaned?
10. Does the stamping waste drop down and how is it discharged?
11. Are waste containers available?
12. Can the tools be clamped in an easy and simple manner? (Clamping grooves in plates or strips)
13. Are all dimensions reliably at nominal dimension?
14. Are the work pieces without pressure marks and damage?
15. Are the markings according to standard? Embossing stamps from Stommel&Voss
16. Are the embossing stamps easy to replace?
17. Are the cutting gaps correct?
18. Are the guides solid?
19. Are difficult to access guides maintenance-free?
20. Are the guides protected against dirt and chips as far as possible?
21. Are the cutting stamps mounted flush?
22. Are the cutting elements easy to replace?
23. Clamping element or hold-down device made of steel and polished
24. Fixing elements made of plastic
25. Are the screwed on workpiece supports and workpiece guides adjustable?
26. If provided, adjustability of elements via tension and pressure screws or via shim plates.
27. Are bend gaps adjustable?
28. Is the index pin adjustable?
29. Are all components pinned?
30. Is a spare parts list available and spare parts package recommended?
31. Do the tools have proper cable and hose installations?
32. Is simple exchange of queries possible?
33. Cables/initiators and junction boxes must be oil-resistant.
34. Are pneumatic-hydraulic-electrical connections according to standard?

5 Index

Acceptance Acceptance reports6

Pressure tests.....	7	Installation certificate.....	22
Qualification approval.....	7	Line direction designation.....	20
Systems requiring monitoring.....	7	Lines.....	20
Accessibility.....	19	Machine data.....	7
Appendix.....	31	Machine data sheet.....	7
Agreements.....	31	Main fuse.....	7
Check list.....	32	Maintenance instructions.....	21
Contacts.....	31	Mechanical documentation.....	7
Installation certificate.....	31	Operating instructions.....	20
Lubrication chart.....	31	Operating manual/operating instructions.....	7
Machine data sheet.....	31	Parameters.....	21
Non-conformance report.....	31	Parts lists.....	21
Spare parts list Electrical engineering.....	31	Project number.....	7
Spare parts list mechanical.....	31	Service documents.....	20
Type plate.....	31	Showing all poles.....	20
Area of dust exposure		Software documents.....	21
Protection class.....	8	Spare parts list.....	21
Safety starter.....	8	Special programs.....	21
Assemblies		Table of contents.....	7
Original state.....	8	Terminal diagrams.....	20
Phase-out types.....	8	Test certificates.....	7, 22
Selection.....	8	Test reports.....	7
Type plate.....	8	Drag chains.....	11, 26
Availability.....	16	Manufacturer information.....	11
Commissioning.....	6	Separators.....	11
Initial commissioning.....	6	Strain relief.....	11
Inspections.....	6	Drawing/project number.....	20
Installation certificate.....	6	Electrical design.....	9
Company logos.....	9	Availability.....	10
Component identification.....	9	Installation.....	10
Engraving unit.....	9	Operational safety.....	10
Compressed air.....	27	Safety.....	10
Contacts.....	2	EMC Directive.....	6
Electrical equipment.....	2	Emergency stop.....	15
Mechanical equipment.....	2	Equipment Safety Act.....	6
Control concept.....	16	Fault finding.....	16
CNC.....	17	Final inspection.....	2, 8
PLC.....	17	Non-conformance report.....	9
Control voltage.....	16	Framework Directive on Waste.....	6
Data transmission.....	16	Fuse.....	19
Bus systems.....	16	Selectivity.....	19
Declaration of Conformity		General information.....	6
CE mark.....	6	Grids.....	27
EC Declaration of Conformity.....	6	Anti-slip class.....	27
Design data.....	9	Anti-slip grades.....	27
Device selection		Heat dissipation.....	15
Motors.....	25	Air conditioning unit.....	15
Documentation		Filter.....	15
Approval.....	7	Forced ventilation.....	15
Cable diagram.....	20	Formation of condense water.....	15
Circuit diagram.....	20	Heat exchanger.....	15
Configuration, parameterisation.....	21	Index.....	33
Connection value.....	7	Industrial Safety Regulation.....	6
Contact configurations.....	20	Installation	
Contacts.....	7	Lines.....	10
Cross-references.....	20	Lines.....	11
Data on CD-ROM.....	7	Silicone cable.....	11
Delivery date.....	7	Suitability.....	11
Descriptions.....	20	Tractive capability.....	11
Device manuals.....	20	Lines Identification.....	10
Documentation.....	7	Lines Installation.....	10
Electrical documentation.....	7, 20	Lines Protection.....	10
Folder content.....	7	Low-Voltage Directive.....	6
Full load/no load current.....	7	Machine Directive.....	6
General part.....	7	Main switch.....	13, 23
GSD files.....	21	Mechanical design.....	27
High level language.....	21	Cleaning.....	27

Cooling lubricants	27	Reserve	
Devices/tools	27	Cable trays	13
Hose lines.....	27	Drag chains	13
Hose routes	27	Fused outgoing circuits	13
Installation	27	Operating panels	13
Purchased parts	27	PLC assemblies	13
Setup and fastening.....	27	Power supply units	13
Stamping tools.....	27	Program memory.....	13
Tensioning elements	27	Switchgears/controls	13
Transport	27	Terminal boxes.....	13
Mechanical documentation.....	28	Risk analysis	9
Spare parts lists.....	29	Selection of electrical devices	23
Mechanical documentation CD-ROM	28	Command /indication units	23
Mechanical documentation Component designation	28	Contactors/relays	24
Mechanical documentation Device manuals	28	Drive technology	25
Mechanical documentation Drawings	28	Installation material	26
Mechanical documentation Hydraulic plans	28	non-electrical quantities.....	25
Mechanical documentation Lubrication charts.....	28	Operation	25
Mechanical documentation Maintenance instructions.....	28	Original state	23
Mechanical documentation Operating instructions	28	PLC	25
Mechanical documentation Parts lists	28	Position switch	24
Mechanical documentation Pneumatic plans	28	Power supply.....	23
Mechanical documentation Service documents.....	28	Power switch	23
Messages	19	Selection of mechanical devices	30
Mobile equipment	16	gen. components.....	30
Motor protection.....	15	Hydraulics	30
Alternating load operation.....	15	Pneumatics	30
Forced cooling.....	15	Shielding	16
Frequency converter.....	15	Manufacturer regulations.....	16
Full motor protection.....	15	Measuring signals	16
Intermittent operation.....	15	Motor lines.....	16
PTC resistors	15	Space reserve	13
Soft starter	15	Surface requirements.....	9
Motor start	15	Surge protection.....	16
Soft starter	15	Switch cabinets	11
Star-delta-start-up.....	15	Base	11
Operating modes.....	18	Cable support rail	11
Automatic operation.....	18	Component distance	11
Manual operation.....	18	Drawing tray	12
Setting up mode	18	Equipping	11
Straightening	18	Fastening	11
Operator stations	12	Grounding	11
Command units	12	Lighting.....	11
Doors and panel plates.....	12	Line feeding.....	11
Function texts	12	Protection class	12
Mobile operator panels	12	Service plug socket	12, 36
Protection class	12	Shield rail	11
Parts list.....	21, 29	Switching rate.....	16
PG-interface	12	Table of contents.....	3
Plant data	8	Terminal boxes.....	12
Network conditions	8	Identification	12
Plant networks.....	8	Protection class	12
Areas with dust exposure	8	Test certificates	7
Compressed air	8	Training/operation	9
Electrical energy supply.....	8	Type plate	11
Input	8	Valve control	11
PEN link.....	8	Indicator lamp.....	11
Pressure dew point.....	8	Plug connection.....	11
Rotating field.....	8	Surge protection.....	11
TN-C-S network.....	8	Warranty.....	9
Potential equalisation	11	Wiring	
Cross-section.....	11	Colour scheme	12
Preliminary test.....	8	Working area lighting	16
Protective barriers	27		

6 Revision History

Changes at Issue:	Date:	Description:
6	11.07.12	- form-number entered at footer - Revision History included
7	30.04.13	- 1 EC-regulation added - 1 NEC 2011 / UL-Standard added - 1.1 BGV A2 replaced by relevant version BGV A3 - 1.1 energetic decrease added - 1.2 UL-Standard added - 1.2.2 machine data added - 1.3. energy efficient devices added - 1.5.1 energetic decrease added - 2.2.2 UL-Standard added - 2.2.2 kilowatt hour meter added - 2.2.7 colour scheme of wiring added - 2.5.5 maintenance information added - 2.6.1 kilowatt hour meter added - 2.6.7 S71200 added - 2.6.9 Energy efficiency grade added - 2.6.10 Micromaster replaced by SINAMICS G120 -Title Page: WKW-Suma GmbH deleted
8	30.08.13	-2.6.1 Kilowatt Hour meter added -2.6.7 ifm, Biehl + Wiedemann added
9	18.11.13	-2.2.1 fixing identification plate -2.2.2 service plug socket (230V) -2.5.8 Software datas -4.4 Template for type plate
10	01.04.14	- Title page "Faulenbach GmbH & Co.KG" added - 2.6.7 "Screw fitting and potential separation" deleted
11	21.11.14	- 2.3.3 electrical drives in the USA -2.6.3 Light barrier: FGS, C4000, C4000 Micro deleted - 2.6.3 Light barrier: Pepper & Fuchs deleted
12	4.12.15	- 1.1 Energetic consideration of media - 4.1.7 Energetic consideration of media - 2.6.1 CM Series deleted (discontinued) - 2.6.7 S7 -1500 added
13	14.09.16	- 1.14 mashine colors -1.5.2 Areas with dust exposure (protection zone 22 deleted)
14	13.01.17	-changed headline -1.14 mashine-colors changed -2.6.1 selection of device/counter kilowatt added -2.2.2 kilowatt hour meter changed (80A to 63 A) -2.2.3 complement of combinations: The application of mobile operator stations -2.6.9 complement of notes
15	24.01.18	- 1.14 mashine-colors changed Footer revised
16	03.04.18	- Header revised - Footer revised - Page 2 phone numbers revised - 2.6.3 Solid 4 deleted (discontinued items) - 3.3.2 Stark and Römheld added - 2.4.1.3 Remote Access added 2.1.1c Cable labelling added
17	09.01.19	-1.5.1.1 connecting conditions revised
18	26.11.19	- 1.1 BGV A3 c hanged to DGUV V3 - 2.6.2 Circuit Breaker type 3RV1 changed to 3RV

		- 2.4.1.4 Profinet device identity added
19	17.06.20	Company name adapted